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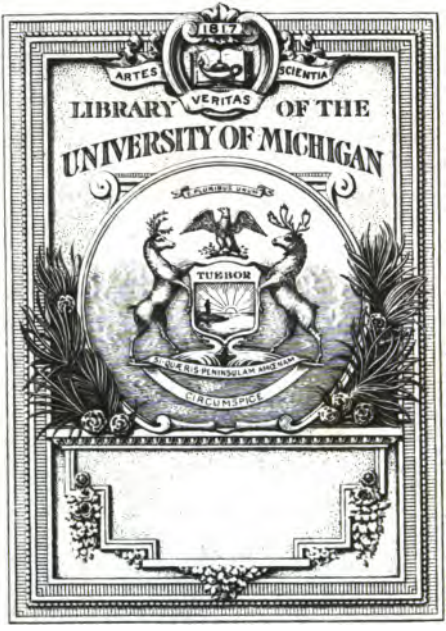
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THE WESTERN

PRACTICAL ARITHMETIC,

WHEREIN

THE RULES ARE ILLUSTRATED, AND THEIR PRINCIPLES EXPLAINED: CONTAINING A GREAT VARIETY OF EXERCISES, PARTICULARLY ADAPTED TO THE

CURRENCY OF THE UNITED STATES:

TO WHICH IS ADDED

A SHORT SYSTEM OF BOOK-KEEPING,

DESIGNED FOR THE USE OF

SCHOOLS AND PRIVATE STUDENTS.

COMPILED

BY JOHN L. TALBOTT.

REVISED AND IMPROVED.

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PREFACE.

In presenting this work to the public, the author makes no pretensions to having discovered any new spring by which to put the youthful mind into action, nor any new method of communicating a knowledge of Arithmetic. He has founded his work on the belief that *labor* and *labor only*, can insure success in any pursuit; and that labor should always be bestowed upon those objects which produce the greatest useful result.

In the selection and arrangement of matter, therefore, those rules that are of the most general use, have been presented first, and their exercises made extensive, that the pupil may early become familiar with their principles, and expert in their application.

The explanations accompanying the rules, are designed to facilitate the progress of private students, and to diminish the labor of teachers, especially in large schools, where they are unable to give to each pupil the necessary explanations.

The MENSURATION of *Carpenters'*, *Masons'*, *Plasterers'* and *Pavers'* work, &c., will be found an acceptable part of Arithmetic, to every man of business, and a practical knowledge of it will contribute much to the security and satisfaction of both workmen and employers, in estimating amounts of work. This has been introduced in consequence of numerous applications to the author to measure various kinds of work, and for instruction in particular rules of Mensuration.

The system of *Book-Keeping*, is thought to be sufficient for all the purposes of *farmers*, *mechanics* and *retailers*, in that necessary branch of a business education.

Finally, the merits of the work rest chiefly upon the *explanations* of the rules, the adoption of the FEDERAL CURRENCY, to the exclusion of pounds, shillings and pence, in general, and the introduction of MENSURATION and BOOK-KEEPING.

How far the author has succeeded in his attempt to compile a *useful work*, particularly adapted to the circumstances of the Western People, remains for *them* to judge, and for *experience* to determine.

TO TEACHERS.

With long experience, and the testimony of many competent and successful teachers, the author of this work is convinced that the best general method of teaching Arithmetic is, to require the pupil to commit the rule to memory, and to acquire the art of applying it, before any effort shall be made on the part of the teacher, to explain the principles upon which the rule is founded.

Many successful teachers pursue a different plan; but it is confidently believed that the above would diminish their labor, and greatly increase the progress of the pupil.

As an occasional exercise, it has been found successful in giving great facility in arithmetical operations, for the teacher to give the whole school, or a whole class, some question that each can work, observing who shall obtain the answer first. When one gives the answer, write down his name as FIRST, and give another question to the rest. Observe, as before, who gives the answer first—write his name next, and so on till each, or nearly every one shall have done one sum. Those who have pursued this plan have met with unusual success in teaching arithmetic.

The above suggestions are made, not with an aim to dictate, but to contribute a mite of experience to the profession, since the eminence of every one consists in the accumulated experience of many.

THE AUTHOR.

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ARITHMETIC.

ARITHMETIC is that part of MATHEMATICS which treats of numbers. It is both a *science* and an *art;*—the *science* explains the nature of numbers, and the principles upon which the rules are founded, while the *art* relates merely to the application of the various rules.

All the operations of arithmetic are conducted by means of FIVE fundamental rules, viz., *Numeration*, (which includes *Notation*,) *Addition*, *Subtraction*, *Multiplication*, and *Division*.

NUMERATION AND NOTATION.

Numeration is the art of representing figures or numbers by words; Notation is the art of representing numbers by characters called figures.

All numbers are represented by the following characters, which are called *figures* or *digits*.

0,	1,	2,	3,	4,	5,	6,	7,	8,	9.
nought,	one,	two,	three,	four,	five,	six,	seven,	eight,	nine.

The *one* is often called a *unit*, it signifies a whole thing of a kind; two signifies two units or ones; three signifies three units or ones, &c.

The value which the figures have when standing alone is called their *simple* value; but in order to denote numbers higher than 9, it is necessary to give them another value called a *local* value, which depends entirely on the order or place in which they stand. Thus, when we wish to write the number *ten* in figures, we do it by combining the characters already known, placing a 1 on the left hand of the 0, thus, 10, which is read *ten*. This 10 expresses ten of the units denoted by 1, but as it is only a *single ten* it is called a *unit*, and the 1 being written in the second order or second place from the right hand to express it, it is called a unit of

of units, and the second, the *place of tens ; ten units of the first order making one unit of the second order.*

When units simply are named, units of the first order are always meant, when units of any other order are intended, the name of the order is always added.

Two tens or twenty,	are	written	20.
Three tens or thirty,	"	"	30.
Four tens or forty,	"	"	40.
Five tens or fifty,	"	"	50.
Six tens or sixty,	"	"	60.
Seven tens or seventy,	"	"	70.
Eight tens or eighty,	"	"	80.
Nine tens or ninety,	"	"	90.
Ten tens or one hundred,	"	"	100.

The numbers between 10 and 20, between 20 and 30, between 30 and 40, &c. may easily be expressed by considering the tens and units of which they are composed. Thus, *eleven* being composed of one ten and one unit, is expressed thus, 11, *twenty-three* being composed of two tens, and three units, is expressed thus, 23. &c.

Sixteen being 1 ten and 6 units, is written thus; 16.
Thirty-nine being 3 tens and 9 units, is written 39.
Sixty-four being 6 tens and 4 units, is written 64.
Ninety-five being 9 tens and 5 units, is written 95.

Ten tens or *one hundred* forms a unit of the third order; it is expressed by placing a 1 in the third place, and filling the first and second places with cyphers, thus, 100. Two hundred is expressed thus, 200. Three hundred thus, 300, &c.

With the orders of units, tens, and hundreds, all the numbers between one and one thousand may be readily expressed. For example, in the number four hundred and twenty-seven, there are 4 hundreds, 2 tens, and 7 units, that is, 4 units of the third order, 2 units of the second order, and 7 units of the first order.

Hence the number is written thus, hundreds 4, tens 2, units 7

In the number three hundred and five, there are 3 hundreds, no tens, and 5 units, or 3 units of the third,

none of the second, and five of the first order, hence the number is written thus,

hun.	tens.	units
3	0	5

Ten units of the order of hundreds, that is ten hundreds form a unit of the fourth order, called *thousands*, written thus, 1000.

In the same manner ten units of the fourth order form a unit of the fifth order, called *tens of thousands*.

The following may be regarded as the principles of Notation and Numeration.

1st. *Ten units of the first or lowest order, make one unit of the second order; ten units of the second order, make one unit of the third order, and universally ten units of any order make a unit of the next higher order.*

2d. *All numbers are expressed by the nine digits, and the cypher, and this is effected by giving to the same figure different values according to the place it occupies.* Thus, 4 in the first place is 4 units, in the second place 4 tens or forty, and so on. This tenfold increase of value by changing the place of the same figure is usually expressed by saying that figures increase from right to left in a tenfold proportion. The names of the orders are to be learned from the

NUMERATION TABLE.

Hundreds of millions.	Tens of millions.	Millions	Hundreds of thousands.	Tens of thousands.	Thousands.	Hundreds.	Tens.	Units.
9	8	7	6	5	4	3	2	1

The orders are likewise divided into periods of six

of Billions.						of Millions.						of Units.					
Hundreds of thousands.	Tens of thousands.	Thousands.	Hundreds.	Tens.	Units.	Hundreds of thousands.	Tens of thousands.	Thousands.	Hundreds.	Tens.	Units.	Hundreds of thousands.	Tens of thousands.	Thousands.	Hundred.	Tens.	Units.

The periods succeeding those in the table, are *Trillions*, *Quadrillions*, *Quintillions*, *Sextillions*, *Septillions*, *Octillions*, and *Nonnillions*, and analogical names might be formed for the succeeding higher periods.

From the preceding remarks the pupil will readily understand the reason of the following rule for numerating or expressing figures by words.

Rule.—Commence at the right hand, and separate the given number into periods, then beginning at the left hand, read the figures of each period as if they stood alone, and then add the name of the period.

Thus, the number 8304000508245, when divided into periods, becomes 8,304000,508245, and is read, *Eight billion, three hundred and four thousand million, five hundred and eight thousand two hundred and forty-five.* The name *unit* of the right hand period is commonly omitted in reading.

EXERCISES IN NUMERATION.

Ex. 1.	35	10.	3700054	19.	20031025
2.	204	11.	6130425	20.	68723145
3.	513	12.	2701030	21.	901023406
4.	2000	13.	3705423	22.	820302008
5,	3054	14.	6803217	23.	310275603
6.	7428	15.	2003005	24.	600000501
7.	10345	16.	70032004	25.	3000400230024
8.	40024	17.	62003005	26.	80000102051003
9.	61304	18.	91010010	27.	50000021375604

28. 4000012000040250014

29. 1000982000375000482000354000271000[illegible]

From the preceding tables and remarks, the pupil will likewise readily understand the reason of the following rule for notation, or expressing numbers by figures.

RULE.—Make a sufficient number of cyphers or dots, and divide them into periods, then underneath these dots write each figure in its proper order and fill the vacant orders with cyphers.

NOTE.—The object of the dots or cyphers, being to guide the learner at first, after a little practice he may dispense with them.

Ex. 1. Write down in figures the number twenty millions three hundred and four thousand and forty. Here millions being the highest period named, we write cyphers to correspond with that, and the period of units, and then underneath these place the significant figures in their proper order, and afterwards fill the vacant orders with cyphers.

0 0 0 0 0 0, 0 0 0 0 0 0
2 0 3 0 4 0 4 0

The pupil must recollect that cyphers being of no use except to fill vacant orders, are never to be placed to the left of whole numbers.

EXERCISES IN NOTATION.

Express the following numbers in figures.

EXAMPLES.

2. Seventy-five.
3. Ninety.
4. One hundred and five.
5. Three hundred and twenty.
6. Nine hundred and four.
7. Eight hundred and ninety.
8. Two thousand three hundred and five.
9. Six thousand and forty.
10. Seven thousand and four.
11. Eight thousand and ninety-five.
12. Ten thousand five hundred and fifty-six.
13. Forty thousand and forty.
14. Ninety-five thousand two hundred and sixty-seven.
15. Eighty thousand one hundred and nine.

16. One hundred and thirty-six thousand two hundred and seventy five.
17. Three hundred and seven thousand and sixty-four.
18. Five hundred thousand and five.
19. One million, two hundred and forty-seven thousand, four hundred and twenty-three.
20. Ten millions, forty thousand and twenty.
21. Sixty millions, seventeen thousand and two.
22. One hundred and four millions two hundred and four thousand and sixty-five.
23. Five hundred and three millions, one hundred and two thousand and nine.
24. Ninety one thousand and two millions, and four.
25. Sixty billions, three millions and forty-one thousand.
26. One billion, one hundred million, one thousand and one.

The *Roman* method of representing numbers, is by means of certain capital letters of the Roman alphabet. Thus:

I	one	XVIII	eighteen
II	two	XIX	nineteen
III	three	XX	twenty
IV	four	XXX	thirty
V	five	XL	forty
VI	six	L	fifty
VII	seven	LX	sixty
VIII	eight	LXX	seventy
IX	nine	LXXX	eighty
X	ten	XC	ninety
XI	eleven	C	one hundred
XII	twelve	CC	two hundred
XIII	thirteen	CCC	three hundred
XIV	fourteen	CCCC	four hundred
XV	fifteen	D	five hundred
XVI	sixteen	M	one thousand
XVII	seventeen	MDCCCXXXVIII	1838

NOTE 1. As often as any letter is repeated, so often is its value repeated.

NOTE 2. A less character before a greater one, diminishes its value.

NOTE 3. A less character after a greater one, increases its value.

QUESTIONS.

What is Arithmetic? When is it a science? When is it an art? What are the fundamental rules of arithmetic? What is numeration? What is notation? What does a unit signify? What does two signify? Three, &c.? What is meant by the simple value of a unit? What does the local value of a figure depend on? How do you write the number ten in figures? Why is the one in this case called a unit of the second order? How many units of the first order does it take to make a unit of the second order? How many units of the second order does it require to form a unit of the third order? &c. Repeat the principles of notation and numeration. Repeat the names of each of the first nine orders as expressed in the numeration table. Repeat the name of each of the periods. Repeat the Rule for numeration. Repeat the Rule for notation.

EXPLANATION OF CHARACTERS.

Signs.	*Significations.*
$=$	equal; as 20s. $=$ £ 1.
$+$	more; as $6 + 2 = 8$.
$-$	less; as $8 - 2 = 6$.
$\times$	into, with, or multiplied by; as $6 \times 2 = 12$.
$\div$	by (*i. e.* divided by;) as $6 \div 2 = 3$; or, 2)6(3.
: :: :	proportionality; as 2 : 4 :: 6 : 12.
$\surd$ or, $\surd$	Square Root; as $\surd 64 = 8$.
$\surd$	Cube Root; as $\surd 64 = 4$.
$\surd$	Fourth Root; as $\surd 16 = 2$, &c.
———	A vinculum; denoting the several quantities over which it is drawn, to be considered jointly as a simple quantity.

SIMPLE ADDITION.

SIMPLE ADDITION is the art of collecting several numbers, of the same name, into one sum.

RULE.

Place the numbers with *units* under *units*, *tens* under *tens*, &c. Begin the addition at the units, or right hand column, and add together all the figures in that column; then, if the amount be less than *ten*, set down the whole sum: but if greater than ten, see how many tens there are, and set down the number above the even tens, and carry *one* for each *ten* to the next column, and proceed with it as in the first.

Proof.—Begin the addition at the top of each column, and proceed as before, and if the result be the same, it is presumed to be right.

EXAMPLES.

(1)	(2)	(3)	(4)
4 3 2	2 3 1	2 1 4	4
2 1 3	4 1 3	1 2 1	2
1 2 1	1 2 1	3 1 2	5
2 1 3	1 3 2	3 2 1	3
9 7 9 sum	8 9 7 sum	9 6 8 sum	1 4 sum

(5)
2 7 6 3 6
7 9 8 0 2
3 8 9 4 1
6 7 8 3 2
5 9 2 4 4
2 7 3 5 4 5

Here 4, 2, 1, 2 and 6 make 15. In fifteen there is *one ten* and five units. Set down the five units under the units column, and carry *one* for the ten to the next or *tens* column.

Then 1, 4, 3, 4, 9 and 3 make 24; in 24 there are two tens, and four over: set down the four under the column of *tens*, and carry *two* to the next or *hundreds* column &c., to the last, where the whole amount may be set down.

(6)

4 7 3 8 6
2 9 4 9 2
1 8 5 8 3
8 9 2 9 4
2 8 8 8 7
7 4 3 9 2

2 8 8 0 3 4

(7)

9 9 7 8 6
8 6 9 3 7
2 7 8 4 9
4 9 8 7 8
7 2 9 3 7
4 8 7 3 2

3 8 6 1 1 9

(8)

7 2 7 5 2
3 7 8 2 3
7 8 7 9 4
2 3 5 6 7
9 8 3 7 2
1 2 3 4 5

3 2 3 6 5 3

(9)

4 7 8 2 3
7 3 7 1 4
2 7 8 3 4
2 3 9 2 5
6 7 8 8 3
6 2 7 3 4

(10)

7 2 6 8 3
9 5 8 9 2
8 2 7 8 3
9 4 9 7 3
7 6 8 9 2
4 3 9 8 7

(11)

8 4 7 3 6
7 8 9 2 8
2 7 8 4 9
6 3 7 8 2
2 8 6 3 7
7 3 8 6 2

(12)

7 3 6 8 4
7 5
4 7 3
6 8 9 3
7
4 8 3
9 6

(13)

9 3 7 6
7 2 3
8 7
9
4 8
9 3 7
9 2

(14)

7 3 7 9
7 4 6 3
7 2 9
4 8 9
7 2
6 8
4 3 2

APPLICATION.

1. Add 224 dollars, 365 dollars, 427 dollars, and 784 dollars, together.

2 2 4
3 6 5
4 2 7
7 8 4

Answer, $ 1 8 0 0 Dollars

2. Add 3742 bushels, 493 bushels, 927 bushels, 643 bushels, and 953 bushels, together.

Answer, 6758 bushels.

3. Add 7346 acres, 9387 acres, 8756 acres, 8394 acres, 32724 acres. Ans. 66607 acres.

4. Henry received at one time 15 apples, at another 115, at another 19. How many did he receive?

Ans. 149.

5. A person raised in one year 724 bushels of corn, in another 3498 bushels, in another 9872. How much in all? Ans. 14094 bushels.

6. A man on a journey, travelled the first day 37 miles, the second 33 miles, the third 40 miles, the fourth 35 miles. How far did he travel in the four days?

Ans. 145 miles.

7. A has a flock of sheep containing 34. B has a flock of 47, and C of fifty-four. How many sheep are there in the three flocks? Ans. 135.

8. The distance from Philadelphia to Bristol is 20 miles; from Bristol to Trenton, 10 miles; from Trenton to Princeton, 12 miles; from Princeton to Brunswick, 18 miles; from Brunswick to New York, 30 miles. How many miles from Philadelphia to New York? Ans. 90.

9. A person bought of one merchant, 10 barrels of flour, of another 20 barrels, of another 95 barrels. How many barrels did he buy? Ans. 125 barrels.

10. A wine-merchant has in one cask 75 gallons, in another 65, in a third 57, in a fourth 83; in a fifth 74, and in a sixth 67 gallons. How many gallons has he in all? Ans. 421 gallons.

Questions.

How many primary rules of Arithmetic are there?

What are they called?

What is addition?

How do you place numbers to be added?

Where do you begin the addition?

Why do you carry one for *ten*, in preference to any other number?

Ans. Because it takes ten *ones* to make one *ten*, ten *tens* to make one *hundred*, &c. (*See table, page* 9.)

SIMPLE SUBTRACTION.

SIMPLE SUBTRACTION is taking a less number from a greater, of the same name, to show the difference between them.

The *greater* number is called the *minuend.*

The *less* number is called the *subtrahend.*

The *difference,* or what is left, is called the *remainder*

RULE.

Place the *less* number under the *greater,* with *units* under *units, tens* under *tens,* &c.

Then draw a line under them; begin at the right hand or units place, and subtract each figure of the subtrahend from the figure of the minuend that is above it, and set the remainder below. When the figure in the subtrahend is greater than the one above it, borrow one (which is one *ten*) from the next figure, and add it to the figure of the minuend; then subtract from the sum.

Proof.—Add the remainder and the subtrahend together, and if the sum equal the minuend, the work is presumed to be right.

EXAMPLES.

(1)		(2)	
7 9 2 5 2 7 4 3	Minuend	9 7 3 8 4 7 6	
3 4 1 2 0 3 1 2	Subtrahend	2 6 1 4 2 5 3	
4 5 1 3 2 4 3 1	Remainder	7 1 2 4 2 2 3	

(3)	
7 2 6 3 9 8 2	Minuend
6 4 2 5 6 3 7	Subtrahend
8 3 8 3 4 5	Remainder

Here we cannot take seven from two; then we must borrow one from the 8: that one is one *ten;* then ten and two are twelve; now take seven from twelve, and five remain.

One is borrowed from the 8, leaving only 7; then take 3 from 7, and 4 remain: or, suppose 8 to remain undiminished; and to cancel the one which is borrowed from the 8, add one to the 3 below, making four; then four from eight and four remain, as before, &c.

(4)

9 2 7 3 8 4 7
2 6 4 1 3 8 6

(5)

8 2 7 0 3 6 8 2
2 7 3 4 1 2 3 7

(6)

7 8 3 7 2 8 6
3 2 7 3 1 9 5

(7)

2 7 3 6 8 3 0 7 0
4 3 2 1 7 2 5

(8)

6 8 4 2 7 3 6 2
3 4 6 1 3 5 2 4

(9)

5 9 3 7 8 4 2 8 3
5 4 3 2 1 4 3 2

(10)

7 9 2 8 3 6 8 4 2
2 4 6 5 3 1 2 8

(11)

9 2 0 3 7 8 4 2
4 1 3 7 2 7 6 1

APPLICATION.

1. From 78 take 32 and what will remain? Answer, 46.

2. From 478 take 324. What will remain? Ans. 154.

3. Charles had 723 apples, and sold 421. How many has he left? Ans. 302.

4. James had 9768 dollars, and gave for a house and lot 3453 dollars. How many has he left? Ans. 6315.

5. A farmer had 3849 acres of land; he gave to his sons 2135 acres. How many acres has he left for himself? Ans. 1714.

6. There are two piles of bricks; one contains 7896, and the other 4389. How many more are there in the one than in the other? Ans. 3507.

6. Reduce 35 tons to drams.

tons.	
35	
20	
700	cwt.
4	
2800	qr.
28	
22400	
5600	
78400	lb.
16	
470400	
78400	
1254400	oz.
16	
7526400	
1254400	
Amount. 20070400	drams.

EXERCISES.

7. Reduce 24 pounds to drams. Amt. 6144 dr.
8. Reduce 36 hundred weight to pounds. Amt. 4032 lb.
9. Reduce 73 quarters to ounces. Amt. 32704 oz.
10. Reduce 2 tons to pounds. Amt. 4480 lb.
11. Reduce 4 tons to drams. Amt. 2293760 dr.

SIMPLE MULTIPLICATION.

SIMPLE MULTIPLICATION is a short method of performing particular cases of addition.

The number to be multiplied, is the *multiplicand.*

The number to be multiplied by, is the *multiplier.*

The number produced is the *product.*

The multiplicand and multiplier are sometimes called *factors.*

MULTIPLICATION TABLE.

Twice	3 times	4 times	5 times	6 times	7 times
1 make 2	1 make 3	1 make 4	1 make. 5	1 make 6	1 make 7
2 4	2 6	2 8	2 10	2 12	2 14
3 6	3 9	3 12	2 15	3 18	3 21
4 8	4 12	4 16	4 20	4 24	4 28
5 10	5 15	5 20	5 25	5 30	5 35
6 12	6 18	6 24	6 30	6 36	6 42
7 14	7 21	7 28	7 35	7 42	7 49
8 16	8 24	8 32	8 40	8 48	8 56
9 18	9 27	9 36	9 45	9 54	9 63
10 20	10 30	10 40	10 50	10 60	10 70
11 22	11 33	11 44	11 55	11 66	11 77
12 24	12 36	12 48	12 60	12 72	12 84

8 times	9 times	10 times	11 times	12 times
1 make 8	1 make 9	1 make 10	1 make 11	1 make 12
2 16	2 18	2 20	2 22	2 24
3 24	3 27	3 30	3 33	3 36
4 32	4 36	4 40	4 44	4 48
5 40	5 45	5 50	5 55	5 60
6 48	6 54	6 60	6 66	6 72
7 56	7 63	7 70	7 77	7 84
8 64	8 72	8 80	8 88	8 96
9 72	9 81	9 90	9 99	9 108
10 80	10 90	10 100	10 110	10 120
11 88	11 99	11 110	11 121	11 132
12 96	12 108	12 120	12 132	12 144

CASE 1.

When the multiplier does not exceed 12.

RULE.—Place the *multiplier* under the *units* figure of the *multiplicand;* and multiply each figure of the multiplicand in succession, and set down the amount, and carry, as in addition.

Proof.—Multiply the *multiplier* by the *multiplicand.*

EXAMPLES.

4231 Multiplicand	342533		73422
2 Multiplier	3		4
8462 Product	1027599		293688
36563	83756	43787	92866
5	6	7	8
182815	502536	306466	742888
4875	7862	3724	7482
9	10	11	12
39375	786220	409664	897844

EXERCISES

1	Multiply 4218	by 2	Product 8436
2	7321	by 3	21963
3	87692	by 4	350768
4	900078	by 9	8100702
5	826870	by 10	8268700
6	278976	by 11	3068736
7	569769	by 12	6837228

CASE 2.

When the multiplier exceeds 12.

RULE.—Place the multiplier as before, with *units* under *units*, &c. Then multiply all the figures of the multiplicand by the *units* figure of the multiplier, setting down the product as before.

Proceed with the *tens* figure in the same manner, observing to set the product of the first figure in the tens place and with the hundreds figure placing the first product in hundreds place, &c., and add the several products together.

EXAMPLES.

1. Reduce 23 tons to hundred weight.

tons.
23
20

Amt. 460 cwt.

2. Reduce 34 hundred weight to quarters.

cwt.
34
4

Amt. 136 quarters.

3. Reduce 42 quarters to pounds.

qrs.
42
28

336
84

Amt. 1176 pounds.

4. Reduce 73 pounds to ounces.

lbs.
73
16

438
73

Amt. 1168 ounces.

5. Reduce 54 ounces to drams.

oz.
54
16

324
54

Amt. 864 drams.

NOTE 1.—When either or both of the factors have noughts on the right hand, they may be omitted in the operation, and annexed to the product. Thus:

47	000	734	00
42	00	42	000
94		1468	
188		2936	
Product	197400000	Product	3082800000

NOTE 2.—When the multiplier is the exact product of any two factors in the multiplication table, the operation may be performed by separating the multiplier into its components, and multiplying first by the one, then its product by the other. Thus:

754 by 36	754	754	754
9	3	6	36
6786	2262	4524	4524
4	12	6	2262
27144	27144	27144	27144

9 and 4, or 3 and 12, or 6 and 6, multiplied together, produces 36, and by using either pair, according to the above note, the true result is obtained.

EXERCISES.

1	Multiply	756	by	42	Product 31752
2		645	by	24	15480
3		876	by	48	42048
4		963	by	56	53928
5		827	by	72	59544

NOTE.—The pupil may work these by all the several pairs of components that he can find in the multiplier.

APPLICATION.

1. Charles has 24 marbles, and John has 4 times as many. How many has John? Ans. 96

2. A gentleman owns 7 houses, for each of which h receives 250 dollars rent. How much does he recei for them all? Ans. 1750.

3. A laborer hired himself to a farmer for four yea at 150 dollars a year. How much did he receive? Ans. 600 dollars.

4. A person wishes to purchase 25 shares of Ban Stock at 75 dollars a share. What must he pay? Ans. 1875 dollars.

5. A mason having built a house, found that 9847 bricks were in it. Suppose he desires to build 14 suc houses, how many bricks must he obtain for th purpose? Ans. 137858O

6. John had 122 pears; Henry had nine times s many; Charles had eight times as many as John an Henry both. How many had Henry and Charles each and how many had they altogether?

Ans. Henry had 1098, Charles, 9760; altogethe 10980

Questions.

What is *multiplication?*

What is the multiplicand?

What is the multiplier?

What is the product?

What are the multiplicand and multiplier sometime both called?

How do you place numbers in multiplication?

How do you proceed when the multiplier does no exceed 12?

When it does exceed 12?

Why do you set the first figure of the product, whe you multiply by the *tens* figure, in the *second* or *tens* place

Why do you set the first figure of the product, whe you multiply by the *hundreds* figure, in the *third* place?

How do you perform the operation when one or mor noughts stand on the right of either or both factors?

How may it be performed when the multiplier is th exact product of any two numbers in the multiplicatio table?

SIMPLE DIVISION.

SIMPLE DIVISION is a short method of performing several subtractions.

The number to be divided is called the *dividend.*

The number by which it is to be divided is called the *visor.*

The number of times that the divisor is contained in e dividend, is called the *quotient.*

So many figures of the dividend as are taken to be vided at one time, is called a *dividual.*

If any thing remain when the operation is completed, is called the *remainder.*

CASE I.—SHORT DIVISION.

When the divisor does not exceed 12.

RULE.—Place the *divisor* on the left hand side of the mber to be divided.

Consider how often the divisor is contained in the first ure or figures of the *dividend*, and set down the result low; observing how many remain, if any. If there no remainder, consider how often the divisor is conned in the next figure: but if there be a remainder, l it so many *tens*, and add the next figure to it, and ide the sum, placing the result beneath, as before.

Proof.—Multiply the quotient by the divisor; add the nainder, if any, and the product will equal the divid.

EXAMPLES.

Dividend.			
Divisor 2)182	2)648	3)963	4)484
Quotient 241	324		

3)741851

247283 + 2 Remainder
3

Proof 741851

Here 3 are contained in 7 *two times*, and one remains; place the *two* under the *seven*, and suppose the *one* that remains to be one *ten*, and add the next figure (4) to it, which makes *fourteen*.

Now 3 are contained in fourteen 4 times, and 2 remain. Set the 4 down under the 4 in the dividend, and suppose the *two* that remain to be two *tens*, and add the next figure (1) to it, which make *twenty-one*. Now 3 into 21 go 7 times, and no remainder. Place the 7 under the 1 in the dividend, and proceed in the same manner with the other figures.

4)65270167

16317541 + 3 Rem.
4

Proof 65270167

5)6572686

1314537 + 1 Rem.
5

Proof 6572686

6)8739627

7)4873692

8)9273684

9)8379286

10)946873

11)893726

12)9879

EXERCISES.

Divide	7893762	by 6	Ans.	1315627
	9387984	by 7		1341140—4
	6928437	by 8		866054—5
	9276874	by 9		1030763—7
	8672934	by 10		867293—4
	6873842	by 11		624894—8
	7369287	by 12		614107—3

CASE 2.—LONG DIVISION.

When the divisor exceeds 12.

RULE.—Place the divisor to the left hand of the dividend, as in case 1.

Consider how often the divisor is contained in the least number of figures into which it can be divided; and set down the result at the right hand of the dividend.

Multiply the divisor by the quotient figure thus found, and set the product under the dividual or figures supposed to be divided.

Subtract the product from the dividual, and set down what remains. Bring down the next figure of the dividend, and proceed as before, till all the figures are brought down and divided.

EXAMPLES.

Divisor. Dividend. Quotient.

27)984376(36458	
81	Twenty-seven into 98 go 3 times: multiply the divisor (27) by 3 and set the product under the dividual (98) and subtract. To the remainder (17) bring down the next figure (4) of the dividend. Now 27 into 174 go 6 times. Place the 6 in the quotient and multiply (27) the divisor, by 6, and set the product under 174 and subtract as before, &c.
174	
162	
123	
108	
157	
135	
226	
216	
—10 Remainder.	

EXERCISES.

1 Reduce 42 years to months. Amt. 504 m.
2 Reduce 23 days to hours. Amt. 552 h.
3 Reduce 36 hours to minutes. Amt. 2160 min.
4 Reduce 25 minutes to seconds. Amt. 1500 sec.
5 Reduce 14 days to minutes. Amt. 20160 min.
6 Reduce 52 hours to seconds. Amt. 187200 sec.
7 Reduce 13 weeks to hours. Amt. 2184 h.
8 Reduce 12 weeks to minutes. Amt. 120960 min.
9 Reduce 3 years to minutes, allowing 365 days to each year. Amt. 1576800 min.
10 Reduce 15 years and 6 months to months. Amt. 186 m.
11 Reduce 4 weeks, 3 days, 22 hours, to hours. Amt. 766 h.
12 Reduce 7 years, 24 days, 43 minutes, to seconds. Amt. 222828180 sec.

STERLING MONEY.

TABLE.

4 farthings (qr) make	1 penny	d.
12 pence	1 shilling	s.
20 shillings	1 pound	

Farthings are usually written as fractions of a penny, thus: ¼ one farthing
½ two farthings or a half penny.
¾ three farthings.

EXERCISES.

1 Reduce 14 pounds to shillings. Amt. 280 s.
2 Reduce 23 shillings to pence. Amt. 276 d.
3 Reduce 34 pence to farthings. Amt. 136 qr.
4 Reduce 4 pounds to pence. Amt. 960 d.
5 Reduce 13 shillings to farthings. Amt. 624 qr.
6 Reduce 16 pounds to farthings. Amt. 15360 qr.
7 Reduce 13 pounds 14 shillings, to pence. Amt. 3288 d.
8 Reduce 3 pounds 15 shillings 6 pence to farthings. Amt. 3624 qr.

NOTE 1.—Cyphers on the right hand of the divisor may be omitted in the operation, observing to separate as many figures from the right of the dividend, which must be annexed to the remainder.

EXAMPLES.

54 | 00)1463 | 40(27	32 | 0)7617 | 3(238
108	64
383	121
378	96
Rem. 540	257
	256
	Rem. 13

EXERCISES.

Divide 40220	by 1900	Ans. 21	Rem. 320
137000	by 1600	85	1000
99607765	by 27000	3689	4765
2304108	by 5800	397	1508

NOTE 2.—When the divisor is the exact product of any two numbers in the multiplication table, the operation may be performed by dividing first by one of the component parts, and then the quotient by the other.

To get the true remainder, multiply the last remainder by the first divisor, and add the first remainder.

EXAMPLES.

42 { 7 \| 98754
{ 6 \| 14107—5 first remainder

2351—1 last remainder
7 first divisor

add { 7
{ 5 first remainder

12 true remainder

$$27 \begin{cases} 3 \mid 984376 \\ 9 \mid 328125\text{—}1 \end{cases}$$

$$36458\text{—}3 \times 3 + 1 = 10 \text{ Rem.}$$

EXERCISES.

Divide	9756	by	35	Quotient 278	Rem. 26
	8491	by	81	104	67
	44767	by	18	2487	1
	92017	by	56	1643	9
	38751	by	48	807	15
	734071	by	72	10195	31

APPLICATION.

1. Seven boys have 161 apples, which they divide equally among them. How many does each have?
Answer, 23.

2. What is the quotient, if 8736 be divided by 8, and that quotient by 4? Ans. 273.

3. If 350 dollars be equally divided among 7 men, what will be the share of each? Ans. 50.

4. How many times are 27 contained in 952?
Ans. 35 times and 7 over.

5. Suppose 2072 trees planted in 14 rows. How many trees will there be in each row? Ans. 148.

6. Several boys who went to gather nuts, collected 4741, of which each boy received 431. How many boys were there? Ans. 11.

7. If the expense of erecting a bridge, which is 15036 dollars, be equally defrayed by 179 persons, what must each pay? Ans. 84 dollars.

8. Suppose a man receive in one year 2920 dollars; how much a day is his income at that rate; and suppose that his expenses for the year amount to 1769 dollars. How much will he save in a year?

Ans. His income will be 8 dollars a day; he will save 1151 dollars in a year.

Questions.

What is division?

What do you call the number that is to be divided?

What do you call the number you divide by?

What do you call the number obtained by division?

What do you call that which is left when the work is done?

When the divisor does not exceed 12, how do you perform the operation?

When the divisor exceed 12, how do you proceed?

How do you prove division?

How may the operation be performed when there are cyphers at the right hand of the divisor?

How may it be performed when the divisor is the exact product of two numbers in the multiplication table?

How do you obtain the true remainder in the last case?

PROMISCUOUS EXERCISES IN THE PRECEDING RULES.

1. If the contents of five bags of dollars, containing $295, $410, $371, $355, and $520, be divided equally among 25 persons, how much is the share of each? Ans. $78.04

2. A man possessed of an estate of $30,000, disposed of it in the following manner: to his brother he gave $1500, and the balance to his 5 sons, to be equally divided among them. What was each one's share?

Ans. $5700.

3. What number is it, which being added to 9709, will make 110901? Ans. 101192.

4. Add up twice 327, three times 794, four times 31196, five times 15890, six times 95280, and once 33304. Ans. 812,344.

5. Three merchants have a stock of 14876 dollars, of which A owns 4963 dollars, B 5188, and C the remainder. How much does C own? Ans. 4725 dollars.

FEDERAL MONEY,

OR MONEY OF THE UNITED STATES.

TABLE.

10 mills make	1 cent
10 cents	1 dime.
10 dimes	1 dollar
10 dollars	1 eagle

These denominations bear the same relation to each other as those of units, tens, hundreds, &c. Federal money is therefore added, subtracted, multiplied, and divided by the same rules as Simple Addition, Subtraction, Multiplication, and Division.

ADDITION OF FEDERAL MONEY.

Rule.

Place the numbers one under another, with mills on the right, cents, dimes, &c., in succession; observing to keep *mills* under *mills*, *cents* under *cents*, &c. Then proceed as in simple addition.

When halves or fourths of a cent occur, find their amount in fourths, and consider how many cents these fourths will make, and carry them to the column of cents.

EXAMPLES.

Eagles.	*Dolls.*	*Dimes.*	*Cents*	*Mills.*		*Dolls.*	*Ds.*	*Cts.*
3	7	8	9	5		7	8	9
7	4	9	8	7		9	7	8
2	3	8	7	9		6	8	4
8	8	9	8	6		6	3	7
4	7	8	9	8		4	8	2
					E.			
27	3	6	4	5	3	5	7	0

NOTE.—In common business transactions, eagles, dimes, and mills are not used: dollars, cents, and fractions of a cent, are the only denominations kept in accounts.

EXAMPLES.

Ds.	cts.
34 ,	62
56 ,	31
27 ,	82
23 ,	68
27 ,	42
169 ,	85

Ds.	cts.
427 ,	68
342 ,	31
427 ,	26
793 ,	84
273 ,	42
2264 ,	51

EXERCISES.

(1)

Ds.	cts.
468 ,	31
723 ,	62
845 ,	92
736 ,	25
846 ,	31
428 ,	62

(2)

Ds.	cts.
927 ,	24
768 ,	32
427 ,	56
792 ,	34
587 ,	62
842 ,	27

(3)

Ds.	cts
273 ,	45
846 ,	37
283 ,	75
846 ,	91
674 ,	75
273 ,	25

Ds.	cts.
437 ,	62½
386 ,	81½
243 ,	18½
427 ,	37½
428 ,	12½
1923 ,	12½

One half is two-fourths; and one half more make four fourths, and three fourths more make seven fourths, and one fourth more make eight fourths, and one half (or two fourths) more make *ten fourths*. Four fourths make one cent, then ten fourths make two cents, and leave two fourths, or one half cent. Set down the ½ cent, and carry the two cents to the next column.

Ds.	cts.
274 ,	81½
362 ,	87½
421 ,	18½
625 ,	31½
241 ,	56½

Ds.	cts.
27 ,	68½
36 ,	81½
28 ,	62½
37 ,	93½
24 ,	62½

Ds.	cts.
56 ,	06½
32 ,	12½
36 ,	25
42 ,	62½
54 ,	81½

APPLICATION.

1. Add 48 dollars 20 cents; 14 dollars 58 cents; 100 dollars 25 cents; and 84 dollars 36 cents.

Ans. 247 dollars 39 cents.

2. Add $7,62½, $34,31¼, $72,06¼, $41,31¾, $25, ¼, and $87,43¾ together, and tell the amount.

Ans. $268,43¾.

3. Bought a hat for $4,25 cents; a pair of shoes for ,25; a pair of stockings for $1,25, and a pair of gloves 75 cents. What is the cost of the whole?

Ans. $8 50 cents.

4. If I buy coffee for $1,18¾, tea for $2,50, cloves 87½, mace for 93¾, cinnamon for $1,87½, raisins for ,68¾, nutmegs for 37½, candles for 87½, and wine for ,93¾, what must I pay for them? Ans. $13,25.

Questions.

What relation do mills, cents, dimes, &c., bear to each ier?

How are the addition, subtraction, multiplication, and ision of Federal money performed?

How do you place the numbers to be added?

How do you proceed when halves, fourths, &c., occur?

SUBTRACTION OF FEDERAL MONEY.

RULE.—Place the less under the greater, with *dollars* der *dollars*, and *cents* under *cents;* then, if there are fractions, proceed as in simple subtraction.

If there is a fraction in the upper sum and none in lower, set it down as a part of the remainder, and ceed as before.

If there is a fraction in each sum, and the lower be s than the upper, subtract the lower from the upper, l set down the difference.

If the lower fraction be greater than the upper one, row one cent, and call it four fourths, and add them the upper fraction, and subtract the lower one from sum.

Proof.—As in simple subtraction.

EXAMPLES.

Ds.	*cts.*	*Ds.*	*cts.*	*Ds.*	*cts.*
32 ,	62	43 ,	68¾	75 ,	68¾
21 ,	31	21 ,	25	24 ,	12½
$11 ,	31	$22 ,	43¾	51 ,	56¼

Ds.	*cts.*
271 ,	62½
132 ,	93¾
138 ,	68¾

NOTE.—*Three* fourths cannot be taken from *two* fourths: then borrow one *cent* from the two cents, which has four fourths in it; add the *four* fourths to the *two* fourths, this makes *six* fourths; subtract *three* fourths from *six* fourths, and three fourths (¾) remain. Set down the ¾ and add one to the next 3, as in simple subtraction.

EXERCISES.

Ds.	*cts.*	*Ds.*	*cts.*	*Ds.*	*cts.*
65 ,	49	520 ,	31¼	436 ,	31¼
35 ,	12½	210 ,	12½	243 ,	18¾
Ds.	*cts.*	*Ds.*	*cts.*	*Ds.*	*cts.*
273 ,	62½	237 ,	56¼	732 ,	31¼
124 ,	37½	142 ,	87½	261 ,	68¾

APPLICATION.

1. Subtract $432,68¾ from 1000,93¼.

Ans. $568,25.

2. Subtraction shows the difference between two numbers; what is the difference between $37,62½ and $93,87½. Ans. $56,25.

3. Bought goods to the amount of $545,95, and paid at the time of purchase $350. How much remains unpaid? Ans. $195,95.

4. A merchant bought a quantity of coffee, for which he paid $560. He afterwards sold it for $610,87½. How much did he gain by the transaction?

Ans. $50,87½

Questions.

How do you place the numbers in subtraction of Federal Money?

How do you perform the operation?

If a fraction occur in the upper line or minuend, what do you do with it?

If a fraction occur in each, how do you proceed?

Suppose the lower fraction is greater than the upper one, how do you proceed?

How do you prove subtraction of Federal Money?

MULTIPLICATION OF FEDERAL MONEY.

RULE.—Set the multiplier under the multiplicand, and if there be no fractions, proceed as in simple multiplication; observing to separate the cents from the dollars in the product.

If there is a fraction in the sum, multiply it, and see how many cents are in the product; set down the fraction that is over, and proceed as before.

Or if the multiplier exceeds 12, multiply the sum, omitting the fractions; then multiply the fraction, and add the number of cents contained in the product, to the product of the rest of the sum.

EXAMPLES.

Ds. cts.	*Ds. cts.*	*Ds. cts.*
12 , 50	10 , 56¼	23 , 62½
4	2	5
$50 , 00	$21 , 12½	$118 , 12½

Ds. cts.

10,87½ 125 times
125 one half make
——— 125 halves: 2
5435 into 125 go 62
2174 times, leaving
1087 one; that is,
62½ one half, mak-
——— ing 62½ cents.
$1359,37½

Ds. cts.

4,18¾ 24 times ¾ are
·24 72 fourths: four
——— fourths are con-
1672 tained 18 times in
836 72 fourths, mak-
18 ing 18 cents.
———
$100,50

EXERCISES.

1	Multiply	$145,18¼	by	7	Ans. $1016,31¼
2		7,87½	by	47	370,12½
3		28,68¾	by	68	1950,75
4		42,31½	by	58	2454,12½
5		137,62½	by	67	9220,87½
6		79,00½	by	207	16354,03½

APPLICATION.

1. What will 8 pounds of cheese come to, at 18 cents a pound? Ans. $1 44 cts.

2. What is the value of 12 yards of linen, at 35 cents a yard? Ans. $4 20 cts.

3. What cost 29 yards of cloth at $2 25 cts. a yard? Ans. $65 25 cts.

4. What will 213 barrels of flour cost, at $5 25 cents a barrel? Ans. $1118 25 cts.

5. Bought 321 barrels of cider at $1 25 cts. a barrel. What did it amount to? Ans. $401 25 cts.

6. What will 580 bushels of salt cost at $1 12½ cts. a bushel. Ans. $652 50 cts.

7. What is the value of 2 pieces of cloth, one containing 38 yards, and the other 26 yards, at $3 87½ cts. a yard? Ans. $248.

8. What will be the cost of 132 pieces of linen at $17 37½ cts. each? Ans. $2293 50 cts.

9. What will 8 cords of wood amount to, at 4 dollars 50 cents a cord? Ans. 36 dollars.

10. Sold 213 barrels of flour for 6 dollars 25 cents per barrel. What is the amount? Ans. 1331 dols. 25 cts.

11. Bought 308 pounds of coffee at 21 cents a pound. What is the amount? Ans. 64 dols. 68 cts.

12. Bought 217 gallons of brandy at $1 18¾ cts. per gallon; and sold it for $1 37½ cts. per gallon. What was the amount paid for the whole; the sum it sold for; and the gain?

Ans. Prime cost, $257 68¾; sold for $298 87½; gain, $41,68¾

DIVISION.

ULE.—Divide as in simple division. When a re-nder occurs, multiply it by 4; and add the number ourths that are in the fraction of the sum (if any) to product: divide this product by the divisor, and its tient will be fourths, which annex to the quotient.

Proof.—As in simple division.

EXAMPLES.

Ds. cts.	*Ds. cts.*	*Ds. cts.*
45,22	3)63,18¾	2)25,37¼
22,61	21,06¼	12,68¾

Ds. cts.

629,68¾(25,18¾
50

129
125

46
25

218
200

18
4

75
25)75(3

Here 18 cents remain; multiply 18 cents by four, brings them to fourths of a cent; add the ¾, this makes 75 fourths: divide 75 fourths by 25, and ¾ are obtained, which place in the quotient.

32)78800(24,62½
64

148
128

200
192

80
64

16
4

32)64(2 or ½
64

EXERCISES.

	D. cts.			
ivide	56,15	by	10	Quotient $ 5,61¼
——	96,00	by	5	—— 19,20
——	156,00	by	4	—— 39,00
——	58,14	by	38	—— 1,53
——	417,96	by	129	—— 3,24
——	494,45	by	341	—— 1,45
——	627,38	by	508	—— 1,23½

APPLICATION.

1. If 7 pounds of butter cost $1,89 cts., what is the value of 1 pound? Ans. 27 cts.

2. If 8 lbs. of coffee cost $2,04 cts., what is the price of one pound? Ans. 25½ cts.

3. Bought 29 yds. of fine linen for $65,25 cts., what was the price per yard? Ans. $2,25.

4. Paid $58,75 cts. for 235 yds. of muslin, what was it per yard? Ans. 25 cts.

5. A piece of cloth containing 72 yds. cost $450, what was it per yard? Ans. $6,25.

Questions.

How do you perform division of Federal Money? How do you proceed when a remainder occurs?

PROMISCUOUS EXERCISES IN THE PRECEDING RULES.

1. Bought 18 barrels of potatoes, each containing 3 bushels, at 25 cts. a bushel, what did they cost? Ans. $13,50.

2. A farmer sold 30 bushels of rye at 87 cts. a bushel, 30 bushels of corn at 53 cts. a bushel; 8 bushel of beans at $1,25 cts. a bushel; 2 yoke of oxen at $62 a yoke; 10 calves at $4 a piece; 15 barrels of cider at $2,37½ a barrel, what was the amount of the whole? Ans. $251,62½.

3. What will be the price of four bales of goods, each bale containing 60 pieces, and each piece 49 yards, at 37½ cents a yard? Ans. $4410.

4. Add $324,43½ cts. $208,09½ cts. and $507,90½ cts. together, and divide the sum by 2, and what will be the result? Ans. $520,21½.

5. Divide 400 dollars, equally, among 20 persons. What will be the portion of each person? Ans. $20.

6. Divide 1728 dollars, equally among 12 persons. What does each one of them share? Ans. $144.

7. If 240 bushels cost 420 dollars; what is the cost of one bushel at the same rate? Ans. $1.75.

REDUCTION.

REDUCTION is the changing of a sum, or quantity, om one denomination to another, without altering the alue.

CASE 1.

o reduce a sum, or quantity, to a lower denomination than its own.

RULE.—Multiply the sum, or quantity, by that num-er of the lower denomination which makes one of its vn.

If there are one or more denominations between the enomination of the given sum, and that to which it is be changed, first change it to the next lower than its vn; then to the next lower, and so on to the deno-ination required.

DRY MEASURE.

TABLE.

2 pints (pts.)	make	1 quart, qt.
8 quarts	-	1 peck, pc.
4 pecks	-	1 bushel, bu.

NOTE.—This measure is used for measuring grain, lt, fruit, &c.

EXAMPLES.

NOTE.—1. To reduce bushels to pecks, multiply by because each bushel has 4 pecks in it.

1. Reduce 23 bushels to pecks.

bu.
23
4

Amt. 92 pecks.

2. Reduce 35 bushels to pecks. Amt. 140 pecks.

NOTE.—2. To reduce pecks to quarts, multiply by 8, ecause each peck has 8 quarts in it.

3. Reduce 27 pecks to quarts.

pe.
27
8

Amt. 216 quarts.

4. Reduce 43 pecks to quarts. Amt. 344 quarts.

NOTE.—3. To reduce quarts to pints multiply by 2, because each quart has 2 pints in it.

5. Reduce 43 quarts to pints.

qt.
43
2

Amt. 86 pints.

6. Reduce 32 quarts to pints. Amt. 64 pints.

Reduce 34 bushels to pints.

bu.
34
4 Multiply the bushels by 4 to bring them to pecks.
136
8 Multiply the pecks by 8 to bring them to quarts.
1088
2 And multiply the quarts by 2 to bring them to pints.

Amt. 2176 pints.

EXERCISES.

7. Reduce 56 pecks to pints. Amt. 896 pints.
8. Reduce 47 bushels to quarts. Amt. 1504 qt.
9. Reduce 85 bushels to pints. Amt. 5440 pt.
10. Reduce 63 pecks to quarts. Amt. 504 qt.
11. Reduce 132 bushels to quarts. Amt. 4224 qt.
12. Reduce 234 bushels to pints. Amt. 14976 pt.

NOTE.—4. When several denominations occur, reduce the highest denomination to the next lower one, and this again to the next lower, and so on; observing to add the amount of each denomination, the number there is

EXAMPLES.

1. Reduce 23 bushels, 3 pecks, 5 quarts, 1 pint, to pints.

bu.	*pe.*	*qt.*	*pt.*	
23	- 3	- 5	- 1	
4				Multiply the bushels by 4 to bring them to pecks, and add the 3 pecks to the amount, which makes 95 pecks.
92				
3				
95				
8				Multiply the pecks by 8 to bring them to quarts, and add the 5 quarts, which makes 765 quarts.
760				
5				
765				
2				Multiply the quarts by 2 to bring them to pints, and add the 1 pint which makes 1531 pints.
1530				
1				
1531 amt.				

Or thus:

bu.	*pe.*	*qt.*	*pt.*	
23	3	- 5	- 1	
4				Multiply by 4 as above; add the 3, and set down the amount, &c.
95				
8				
765				
2				
1531 Amt. as before.				

EXERCISES.

1. Reduce 13 bushels, 2 pecks, 7 quarts, 1 pint to pints. Amt. 879 pints.

2. Reduce 24 bushels, 3 pecks, 1 quart to quarts.
Amt. 793 qt.
3. Reduce 7 bushels, 3 pecks to quarts. Amt. 248 qt.
4. Reduce 3 pecks, 2 quarts to pints. Amt. 52 pt.
5. Reduce 7 quarts, 1 pint, to pints. Amt. 15 pt.
6. Reduce 32 bushels, 0 pecks, 1 quart to pints.
Amt. 2050.
7. Reduce 5 bushels, 1 peck, 0 quarts, 1 pint to pints.
Amt. 337 pt.
8. Reduce 43 bushels, 1 peck to pints.
Amt. 2768 pt.

Questions.

What is reduction?
For what is case first used?
How do you reduce a sum to a lower denomination than its own?
How do you reduce bushels to pecks?
Why do you multiply by 4?
How do you reduce pecks to quarts?
Why do you multiply by 8?
How do you reduce quarts to pints?
How do you reduce bushels to pints?

AVOIRDUPOIS WEIGHT.

TABLE.

16 drams (dr.) make		1 ounce,	oz.
16 ounces	-	1 pound,	lb.
28 pounds	-	1 quarter of a cwt.	qr.
4 quarters, (or 112 lb.)*		1 hundred weight,	cwt.
20 hundred weight		1 ton,	T.

NOTE.—By this weight are weighed, tea, sugar, coffee, flour and other things subject to waste, and all the metals, except silver and gold.

* The gross hundred weight of 112 pounds is nearly out of use; the decimal hundred weight of 100 pounds is taking its place.

to the upper figure on the right, subtract the lower figure from the sum, and set down the remainder.

When you borrow one from the upper figure, why do you add one to the figure below it?

NOTE.—Upon a clear conception of the principles involved in these questions, depends the pupil's correct knowledge of the *science* of Arithmetic.

AVOIRDUPOIS WEIGHT.

	tons	*cwt.*	*qr.*	*tons*	*cwt.*	*qr.*	*lb.*	*cwt.*	*qr.*	*lb.*	*oz.*	*dr.*
From	45	11	3	52	12	3	15	17	0	0	0	0
Take	15	10	2	24	10	0	26	6	3	21	15	9
Rem.	30	1	1	28	2	2	17	10	0	6	0	7

1. Subtract 76 tons, 18 hundred weight, 3 quarters, from 195 tons, 2 hundred weight, 2 quarters.

Ans. 118 tons, 3 cwt. 3 qr.

2. Subtract 14 pounds, 6 ounces, 3 drams from 20 pounds, 2 ounces. Ans. 5 lbs. 11 oz. 13 dr.

APOTHECARIES WEIGHT.

℔	℥	ʒ	℔	℥	ʒ	℈	*gr.*
1090	1	6	48	9	6	1	4
106	2	7	1	10	0	2	8
983	10	7					

3. From 59℔ 1℥ 2ʒ take 53℔ 7℥ 5ʒ. Ans. 5℔ 5℥ 5ʒ.

4. Subtract 14℔ 9℥ 1ʒ from 69℔. Ans. 54℔ 2℥ 7ʒ.

TROY WEIGHT.

lb.	*oz.*	*dwt.*	*gr.*	*lb.*	*oz.*	*dwt.*	*gr.*	*lb.*	*oz.*	*dwt.*	*gr.*
10	6	18	0	8	3	0	2	106	0	0	15
4	0	2	20	2	1	18	6	10	6	2	20
6	6	15	4								

4. Subtract 14*lb.* 6*oz.* 11*dwt.* from 22*lb.* 12*dwt.* 6 *gr.*

Ans. 7*lb.* 6*oz.* 1*dwt.* 6*gr.*

5. From 16*lb.* take 12*lb.* 11*oz.* 10*dwt.* 11*gr.*

Ans. 3*lb.* 0*oz.* 9*dwt.* 13*gr.*

CLOTH MEASURE.

	yds.	*qrs.*	*na.*	*E.E.*	*qrs.*	*na.*	*E. Fl.*	*qrs.*	*na.*
From	71	3	1	42	0	2	51	2	2
Take	14	2	3	19	2	3	42	2	1
Rem.	57	0	2	22	2	3	9	0	1

4. Subtract 95 yards, 3 quarters, 2 nails, from 156 yards, 2 quarters, 3 nails. Ans. 60 yds. 3 qr. 1 nail.

5. Subtract 14 English ells, 1 quarter, 2 nails, from 52 English ells, 3 quarters, 2 nails. Ans. 38 yds. 2 qr.

LONG MEASURE.

	L.	*M.*	*fur.*	*L.*	*M.*	*fur.*	*P.*	*yds.*	*ft.*	*in.*
From	24	1		56	1	0	19	6	2	10
Take	18	2	4	10	0	7	20	3	2	7
Rem.	5	2	3	46	0	0	39	3	0	3

4. Subtract 45 miles, 5 furlongs, 20 poles, from 320 miles, 3 furlongs, 36 poles. Ans. 274 M. 6 F. 16 P.

5. Subtract 15 yards, 2 feet, 6 inches, from 36 yards, 1 foot, 11 inches. Ans. 20 yds. 2 ft. 5 inches.

LAND, OR SQUARE MEASURE.

	A.	*R.*	*P.*	*A.*	*R.*	*P.*	*Yds.*	*ft.*	*in.*
From	96	3	36	195	2	2	25	2	72
Take	25	2	39	36	3	1	14	7	10
Rem.	71	0	37	158	3	1	10	4	62

4. Subtract 36 acres, 2 roods, from 900 acres, 3 roods, 16 perches. 864 A. 1 R. 16 P.

5. Subtract 72 acres, from 360 acres, 2 roods, 29 perches. 288 A. 2 R. 29 P.

CUBICK MEASURE.

yds.	*ft.*	*in.*	*cords.*	*ft.*	*in.*
79	11	917	349	97	1250
17	25	1095	192	127	1349
61	12	1550	156	97	1629

1. From a pile of wood containing 432 cords, 27 feet, and 1432 inches, have been hauled 156 cords, 92 feet, 946 inches: how much remains?

Ans. 275 cords, 63 feet, 486 in.

2. From a bank of earth containing 2984 yards, 18 feet, have been taken 1436 yards, 21 feet: what remains? Ans. 1547 yds. 24 feet.

LIQUID MEASURE.

T.	*hhd.*	*gal.*	*qt.*	*pt.*
2	3	50	1	0
1	2	16	3	1
1	1	33	1	1

T.	*hhd.*	*gal.*	*qt.*	*pt.*
100	1	19	2	1
99	1	28	3	1

3. If I purchase 2*hhd.* of wine, and to oblige a friend send him 29*gal.*, what quantity have I left?

Ans. 1*hhd.* 34*gal.*

4. Bought 1 pipe of wine, 4*hhd.* of brandy, 2 barrels of beer; I have since sold 93 gallons of wine, 29 of brandy, 1 barrel of beer: how much of each have I remaining?

Ans. 33*gal.* of wine, 223*gal.* of brandy, and 1 barrel of beer.

MOTION.

°	′	″
79	21	31
41	41	52
37	39	39

Sin.	°	′	″
6	10	12	48
3	8	39	29
3	1	33	19

A circle being 12 sines, how far has the hand of a watch to pass, after having gone through 4 sines, 23° 15′ 29″ ?

Sin.	°	′	″
12	0	0	0
4	23	15	29

2 A person residing in latitude 27° 32′ 45″ north, wishes to visit a place 52° 24′ 18″ north. How many degrees, minutes, and seconds northward must he travel? Ans. 24° 51′ 33″.

TIME.

Y.	*M.*	*w.*	*d.*	*ho.*	*min.*	*sec.*	*H.min.sec.*	*Y.*	*M.*
6	9	3	1	3	40	20	16 29 33	18	11
1	6	2	6	2	57	36	7 36 44	9	10
5	3		2	0	42	44			

4. From 900 *Y.* take 111 *Y.* 6 *m.*

Ans. 788 *Y.* 6 *m.*

5. If I take 1 *Y.* 1 *M.* from 6 *Y.* what space of time will still remain?

Ans. 4 *Y.* 11 *M.*

NOTE.—To ascertain the amount of time passed between two events, set down the *year*, *month*, and *day* of the latter event, and place those of the former below it, and subtract.

6. A bond was given 24th July, (7th month) 1809, and paid off 13th August, 1821.

yrs.	*mo.*	*ds.*
1821	8	13
1809	7	24
12	0	20

7. The declaration of independence of the United States passed Congress, 4th July, (7th month) 1776; and the declaration of the late war with Great Britain, 18th June, (6th mo.) 1812. How many years, &c. between them? Ans. 35yr. 11mo. 14d.

STERLING MONEY.

£.	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
146	19	10½	47	6	7½	419	7	6
7	19	9½	28	5	10½	227	8	9½
139	0	0½						

4. Subtract £200 9*s.* from £1000 11*s.* 11¼*d.*
Ans. £800 2*s.* 11¼*d.*

5. I have a purse of money containing £1000 2*s.* 4¼*d.*: if I take out £60 7*s.* 8¾*d.* what sum will be left?
Ans. £939 14*s.* 7¼*d.*

COMPOUND MULTIPLICATION.

COMPOUND MULTIPLICATION is the art of multiplying numbers composed of several denominations.

CASE 1.

When the multiplier does not exceed 12.

RULE.

Place the number to be multiplied as directed in compound addition; and set the multiplier under the lowest denomination.

Multiply as in simple multiplication, and divide the product of each denomination by as many as it takes of that to make one of the next greater; set down the remainder (if any) and carry the quotient to the product of the next denomination.

Proof.—Double the multiplicand and multiply by half the multiplier.

EXAMPLES.

Bu.	*pe.*	*qt.*	*pt.*
7	2	5	1
			7
53	2	6	1

7 times 1 pint make 7 pints; 2 pt. make 1 qt.; then 7 pt. make 3 qt. and leave 1 pt. Set down the 1 pt. and carry the 3 qt. to the product of the next figure.

7 times 5 qt. make 35 qt. to which add the 3 qt. which make 38 qt.; 8 qt. make one peck; then 38 qt. make 4 pecks and leave 6 qts. Set down the six quarts and carry the 4 pecks.

7 times 2 pecks make 14 pecks; add the 4 pecks, makes 18 pe.; 4 pecks make one bushel; then 18 pe. make 4 bushels and leave 2 pecks. Set down the 2 pecks and carry the 4 bushels.

7 times 7 bushels make 49 bushels; add the 4 bushels, makes 53 bushels, which set down, and the work is done.

Bu.	pe.	qt.	pt.	Bu.	pe.	qt.	pt.
9	3	6	1	23	2	5	1
			5				8
49	3	0	1	189	1	4	0

1. In one vessel are contained 29 bushels 2 pecks and 5 quarts: how many in 9 such vessels?

Ans. 266 bu. 3 pe. 5 qt.

2. If one tub will contain 8 bu. 3 pe. 5 qt. how much will 11 such tubs contain? Ans 97 bu. 3 pe. 7 qt.

Case 2.

When the multiplier exceeds 12, *and is the exact product of two factors in the multiplication table.*

RULE.

Multiply the given sum by one of the factors, and the product by the other factor.

Proof.—Change the factors.

EXAMPLES.

1. Multiply 3 bushels, 2 pecks, 7 qt. by 24. Product

bu.	pe.	qt.	bu.	pe.	qt.
3	2	7	3	2	7
		6			4
22	1	2	14	3	4
		4			6
89	1	0 Proof	89	1	0

OR THUS:

bu.	pe.	qt.	bu.	pe.	qt.
3	2	7	3	2	7
		3			8
11	0	5	29	3	0
		8			3
89	1	0	89	1	0

2. Multiply 7 bushels, 3 pecks, 5 quarts, by 36.

Product, 284 bu. 2 pe. 4 qt.

3. Multiply 19 bushels, 2 pecks, 3 quarts, by 42

CASE 3.

When the multiplier exceeds 12, *and is* NOT *the* ***product*** *of any two factors in the multiplication table.*

RULE.

Multiply by the two factors whose product is the *least* short of the given multiplier; then multiply the *given* sum by the number which supplies the deficiency; and add its product to the sum produced by the two factors.

EXAMPLES.

1. Multiply 21 bushels, 1 peck, 7 quarts, by 23. Prod.

bu.	*pe.*	*qt.*			*bu.*	*pe.*	*qt.*	
21	1	7×3			21	1	7×2	
		5					3	
			OR THUS:					
107	1	3			64	1	5	
		4					7	
429	1	4	product of 20		450	3	3	product of 21
64	1	5	product of 3		42	3	6	product of 2
493	3	1	product of 23		493	3	1	product of 23

2. Multiply 19 bushels, 3 pecks, 7 quarts, by 34. Product, 678 bu. 3 pe. 6 qt.
3. Multiply 7 bushels, 3 pecks, 4 quarts, by 59.
4. Multiply 9 bushels, 3 pecks, 2 quarts, by 47.
5. Multiply 15 bushels, 1 peck, 7 quarts, by 78.
6. Multiply 12 bushels, 2 pecks, by 92.
7. Multiply 17 bushels, 3 quarts, by 98.
8. How many bushels in 104 sacks, each containing 7 bushels, 2 pecks, 3 quarts?
9. How many bushels of wheat on 125 acres, containing 21 bushels, 3 pecks each?

Case 4.

When the multiplier is greater than the product of any two numbers in the multiplication table.

RULE.

Multiply the given number by 10, as many times less one as there are figures in the multiplier.

Multiply that product by the left hand figure of the multiplier.

Multiply the given sum by the units figure of the multiplier; the product of the first 10 by the *tens* figure of the multiplier; the hundreds product by the *hundreds* figure of the multiplier, and so on, till you have multiplied by all the figures of the multiplier except the left hand one.

Add all the products together, and you have the product required.

EXAMPLES.

1. Multiply 3 bushels, 3 pecks, 1 quart, by 456.

bu.	*pe.*	*qt.*	
3	3	1	×6
		10	
37	3	2	×5
		10	
378	0	4	
		4	
1512	2	0	
22	2	6	
189	0	2	
1724	1	0	Product

Product 1724 bu. 1 pe.

Because there are 3 figures, multiply 2 times by 10. Multiply that product by the left hand figure (4) of the multiplier. Multiply the given number by the units figure (6) and set the product beneath. Multiply the 10's product by the *tens* figure (5) of the multiplier. Add the several products.

Multiply 53 bushels, 2 pecks, 7 quarts, by 2345.

	pe.	*qt.*		
	2	7×5		
		10		
	0	6+4		
		10		
	3	4+3		
		10		
	3	0		
		2		
	2	0	product of the	2000
	2	4	" "	300
	3	0	" "	40
	2	3	" "	5
	1	7	Product of the	2345

.—Let the pupil try experiments, by multiplying simple numbers this way.

Multiply 72 bushels, 1 peck, 2 quarts, by 4723.

Product, 341531 bu. 3 pe. 6 qt.

Multiply 13 bushels, 2 pecks, 4 quarts, by 5124.

Questions.

at is *compound multiplication?*

what does it differ from simple multiplication?

en the multiplier does not exceed 12, how do you d?

w many do you always carry?

w do you prove compound multiplication?

w do you proceed when the multiplier exceeds 12,

the exact product of two numbers in the multiplication table?

en the multiplier exceeds 12, and is *not* the exact ct of any two numbers in the table, how do you d?

How do you procced when the multiplier is greater than the product of any two numbers in the table?

AVOIRDUPOIS WEIGHT.

tons.	*cwt.*	*qrs.*	*cwt.*	*qr.*	*lb.*	*oz.*	*dr.*
23	12	3	7	3	14	9	6
		4					6
94	11	0	47	1	3	8	4

tons	*cwt.*	*qr.*	*cwt.*	*qr.*	*lb.*	*oz.*	*dr.*
7	15	3	7	3	24	12	14
		8					9

5. Multiply 7 tons, 16 cwt. 3 qr. by 24.
Product, 188 T. 2 cwt.
6. Multiply 3 cwt. 2 qr. 21 lb. 14 oz. by 30.
Product, 110 cwt. 3 qr. 12 lb. 4 oz.
7. Multiply 3 tons, 7 cwt. 2 qr. by 34.
Product, 114 tons 15 cwt.

APOTHECARIES WEIGHT.

℔	℥	ʒ	℈	℔	℥	ʒ	℈	*gr.*	℔	℥	ʒ	℈	*gr.*
4	8	2	1	53	10	0	2	12	17	5	6	1	4
			5					9					12
23	5	3	2										

TROY WEIGHT.

lb.	*oz.*	*dwt.*	*lb.*	*oz.*	*dwt.*	*gr.*	*lb.*	*oz.*	*dwt.*	*gr.*
67	5	16	43	0	8	10	113	6	0	6
		2				4				6
134	11	12								

4. Multiply 41 lb. 6 oz. 18 dwt. 2 gr. by 7.
Ans. 291 lb. 0 oz. 6 dwt. 14 gr.
5. Multiply 91 lb. 4 oz. 14 dwt. 16 gr. by 8.
Ans. 731 lb. 1 oz. 17 dwt. 8 gr.

CLOTH MEASURE.

yd.	*qr.*	*na.*	*E. E. qr.*	*na.*	*E. Fl. qr.*	*na.*	*E. Fr. qr.*	*na.*
20	2	3	37	4 2	18	0 3	14	1 3
		6		8		12		9
124	0	2						

5. If 19 yd. 1 qr. 2 na. be multiplied by 5, what number of yards will there be? Ans. 96 yds. 3 qr. 2 na.

6. Multiply 56 Ells Eng. 3 qr. by 9.
Ans. 509 Ells E. 2 qr.

LONG MEASURE.

deg.	*m.*	*fur.*	*p.*	*l.*	*m.*	*fur.*	*p.*	*m.*	*fur.*	*p.*	*yd.*	*ft.*	*in.*
8	1	3	36	4	2	2	29	18	3	20	1	2	10
			12				7						5
96	17	6	32										

4. Multiply 6 deg. 40 m. 7 fur. by 10.
Ans. 66 deg. 48 m. 6 fur.

5. Multiply 44 m. 6 fur. 20 p. by 7.
Ans. 313 m. 5 fur. 20 p.

LAND, OR SQUARE MEASURE.

a.	*r.*	*p.*	*a.*	*r.*	*p.*	*a.*	*r.*	*p.*
49	2	17	19	3	20	10	0	33
		2			6			9
99	0	34						

4. How many acres will 10 men reap in one day, allowing them 1 acre 3 roods 11 perches each?
Ans. 18 A. 0 R. 30 P.

5. Multiply 63 acres 3 roods 18 perches, by 11.
Ans. 702 A. 1 R. 38 P.

6. How many acres in 15 lots, containing 17 acres, 2 roods, and 20 perches each? Ans. 264A. 1R. 20P.

CUBIC MEASURE.

cords.	*ft.*	*in.*
7	28	1327
		6
43	44	1050

yd.	*ft.*	*in.*
19	23	1421
		8
159	1	1000

cords.	*ft.*	*in.*
21	56	1432
		7

yd.	*ft.*	*in.*
27	13	1291
		9

5 In a pile of wood are 14 cords 92 feet; how much in 24 such piles? Ans. 353 c. 32 ft.

6 In a cellar, are contained 42 yards 25 feet; what are the contents of 23 such cellars? Ans. 987 yd. 8 ft.

LIQUID MEASURE.

hhd.	*gal.*	*qt.*
8	43	2
		4
34	48	0

T.	*hhd.*	*gal.*	*qt.*	*pt.*
1	2	16	3	1
				10

pi.	*hhd.*	*gal.*	*qt.*	*pt.*
4	1	19	3	1
				5

4 Multiply 3 T. 2 hhd. 50 gal. 2 qt. by 8.
Ans. 29 T. 2 hhd. 26 gal. 0 qt.

5 Multiply 4 hhd. 41 gal. 1 pt. by 10.
Ans. 46 hhd. 33 gal. 1 qt. 0 pt.

MOTION.

sin.	°	′
3	27	48
		7
27	14	36

sin.	°	′	″
1	24	48	25
			9
16	13	15	45

3 If a planet move through 2*sin.* 15° 23′ of its orbit in one day; how far will it advance in 8 days.
Ans. 20*sin.* 3° 4′

TIME.

re.	*mo.*	*weeks.*	*d.*	*h.*	*d.*	*h.*	*min.*	*sec.*
	8	3	5	23	3	14	25	36
	7			8				9
	8	30	5	16	32	9	50	24

If a man can perform a piece of work in 2 yr. 3 mo., long would it take him to perform 5 such?

Ans. 11 yr. 3 mo.

If a laborer dig a drain in 2 weeks, 3 days, how long me would he require to dig 9 such drains?

Ans. 21 weeks 6 days.

STERLING MONEY.

£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
246	13	3¼	14	6	0¼	111	11	10¼
		11			9			10
2713	6	5¼						

	£	*s.*	*d.*			£.	*s*	*d.*
Multiply	37	6	9¼	by 5	Prod.	186	13	11¼
—	56	8	7¾	by 9	—	507	17	9¾

COMPOUND DIVISION.

Compound Division is the art of dividing a sum ch consists of several denominations.

Case 1.

When the divisor does not exceed 12.

Rule.

ivide the several denominations of the given sum, after another, beginning with the highest, and set respective quotients underneath.

hen a remainder occurs, reduce it to the next lower omination, and add it to the number of the next de- ination, and divide the sum as before.

EXAMPLES.

	bu.	*pe.*	*qt.*	*pt.*
7)	25	2	6	1
	3	2	5	1

Here 7 into 25 bu. 3 times and 4 remain. Set down the 3.

Reduce the 4 bushels to pecks, which makes 16 pecks: add 16 pecks to 2 pecks, which make 18 pecks.

Now 7 into 18 pe. 2 times, and leave 4. Set down the 2.

Reduce the 4 pecks to quarts, which makes 32 qts. Add 32 qt. to 6 qt.—makes 38 qt.

7 into 38 qt. 5 times, and 3 remain. Set down the 5.

Reduce the 3 qt. to pt.—makes 6 pt., add 6 pt. to 1 pt. makes 7 pints.

7 into 7, 1 time. Set down the 1, and the work is completed.

	bu.	*pe.*	*qt.*
2)	8	2	6
	4	1	3

	bu.	*pe.*	*qt.*
3)	9	3	6

4 Divide 34 bu. 3 pe. 6 qt. between 9 persons.

Ans. 3 bu. 3 pe. 4 qt.

5 92 bu. 3 pe. belong equally to 7 persons; what is the share of each? Ans. 13 bu. 1 pe.

Case 2.

When the divisor exceeds 12, and is the exact product of two numbers in the multiplication table.

Rule.

Divide the sum by one of the factors, and the quotient by the other.

Multiply the last remainder by the first divisor, and add the first remainder for the true remainder, as in simple division, note 2.

EXAMPLES.

1 Divide 89 bu. 3 pe. 7 qt. by 28.

Quotient 3 bu. 6 qt. 1 pt.—18 rem.

		bu.	*pe.*	*qt.*	
28	4 |	89	3	7	
	7 |	22	1	7—3	Rem.
		3	0	6—5	Rem.
				4	First divisor
				20	
				3	First rem.
		True rem.		23	Quarts
				2	
				28)46	pints
				Pt. 1	and a rem. of 18 pints undivided.

3. Divide 78 bushels, 3 pecks, 4 quarts, among 36 persons; what will be the share of each?

Ans. 2 bu. 1 pe. 6 qt. 1 pt. and a remainder of 24 pints undivided.

Case 3.

When the divisor is more than 12, and is NOT the exact product of any two numbers in the multiplication table.

RULE.

Divide the highest denomination of the given sum, as in case 2, simple division; and reduce the remainder, if any, to the next lower denomination; add the number of that denomination to the result, and divide as before.

EXAMPLES.

1. Divide 77 bushels, 1 peck, 7 quarts, by 23.

Quotient, 3 bu. 1 pe. 3 qt. 1 pt. 13 rem.

EXAMPLES.

bu. pe. qt. bu. pe. qt. pt.

23)79 1 7(3 1 6 1+3 pint remaining.
69
—
10
4
—
23)41(1 peck
23
—
18
8
—
23)151(6 quarts
138
—
13
2
—
23)26(1 pint
23
—
Rem. 3 pints

2. A boat load of corn, containing 4927 bushels, 3 pecks, is owned equally by 29 persons: what is the share of each?

Ans. 169 bu. 3 pe. 5 qt. 1 pt., and a rem. of 1 pint.

Questions.

What is *compound division?*

When the divisor does not exceed 12, how do you proceed?

When a remainder occurs, what do you do with it?

Where the divisor exceeds 12, but is the product of two numbers in the table, how do you perform the operation?

How do you find the *true remainder* in the latter case?

When the divisor is more than 12, and is *not* the product of any two numbers in the table, how do you perform the operation?

AVOIRDUPOIS WEIGHT.

tons	*cwt.*	*qr.*	*lb.*	*lb.*	*oz.*	*dr.*
37	17	3	27	7)46	12	14
6	6	1	9–1 rem.	6	10	15–5 R.

ons	*cwt.*	*qr.*	*cwt.*	*qr.*	*lb.*	*oz.*	*dr.*
92	3	3	9)75	3	23	14	2

5. A quantity of iron weighing 473 tons, 19 cwt., quarters, is owned equally by 22 persons; what is the are of each?

Ans. 21 T. 10 cwt. 3 qr. 16 lb. 8 oz. 11 dr. Rem. 14 dr.

APOTHECARIES WEIGHT.

℔	℥	ʒ	℈
4)23	7	5	1
5	10	7	1

℔	℥	ʒ	℈	*gr.*
5)41	6	7	2	14
8	3	6	1	2–4 rem.

℔	℥	ʒ	℈
6)46	9	1	2

℔	℥	ʒ	℈	*gr.*
7)93	7	5	2	14

5. Divide 127℔ 3℥ 6ʒ into 17 equal parcels: how uch in each parcel? Ans. 7℔ 5℥ 6ʒ 2℈ 16 gr. 8 rem.

TROY WEIGHT.

lb.	*oz.*	*dwt.*
8)34	10	15

lb.	*oz.*	*dwt.*	*gr.*
7)45	11	16	22

lb.	*oz.*	*dwt.*
9)78	9	16

lb.	*oz.*	*dwt.*	*gr.*
8)82	7	14	21

CLOTH MEASURE.

yd.	*qr.*	*na.*
5)27	3	1
5	2	1

Ells E.	*qr.*	*na.*
6)37	3	2
6	1	1+4 rem.

yd.	*qr.*	*na.*
7)45	3	2

Ells E.	*qr.*	*na.*
8)37	3	1

LONG MEASURE.

l.	*m.*	*f.*
6)37	2	2
6	0	7

m.	*f.*	*p.*	*yd.*
7)46	7.	17	3
6	5	25	2

yd.	*ft.*	*in.*
6)53	2	9

m.	*f.*	*p.*	*yd.*	*ft.*
7)87	6	23	4	2

5. A traveller has a journey of 946 miles, 6 furlongs, to perform in 26 days; how far must he travel each day? Ans. 36 m. 3 f. 12 p. 8 rem.

LAND, OR SQUARE MEASURE.

A.	*R.*	*P.*
7)37	3	27
5	1	26+5 Rem.

A.	*R.*	*P.*	*yds.*
9)423	3	28	2
47	0	16	13+5 Rem.

3. A farm containing 746 acres, 3 roods, 29 poles, is to be divided equally between 9 heirs; what is the share of each? Ans. 82 A. 3 R. 38 P. and 7 rem.

CUBIC MEASURE.

cords	*ft.*
8)97	48
12	22

yd.	*ft.*	*in.*
9)148	16	493
16	13	1398+7R.

3. A boat load of wood, containing 92 cords 87 feet, is to be divided between 3 persons; what is the share of each? Ans. 30 c. 114 ft. 1 rem.

4. A quantity of earth, containing 6987 yards, 25 feet, is to be removed by 29 carters; how much must each remove? Ans. 240 yd. 26 ft.

LIQUID MEASURE.

tuns.	*hhd.*	*gal.*	
5)37	3	45	
7	2	21	+3 Rem.

hhd.	*gal.*	*qt.*	*pt.*	
6)57	36	3	1	
9	37	2	1	+1 Rem.

tuns	*hhd.*	*gal.*
7)84	2	32

hhd.	*gal.*	*qt.*	*pt.*
8)23	43	3	1

5. A quantity of liquor owned equally by 27 persons, the whole quantity being 431 hhd. 47 gals; what is the share of each? Ans. 15 hhd. 62 gal. 1 qt.; 17 rem.

MOTION.

Sin.	°	′	″
8)9	16	45	36
1	5	50	42

Sin.	°	′	″
9)11	23	48	[illegible]

TIME.

yr.	*mo.*
11)848	10
77	2

we.	*da.*	*ho.*	*min.*	*sec.*
12)24	6	20	32	24
2	0	13	42	42

yr.	*mo.*
4)375	8

da.	*ho.*	*min.*	*sec.*
7)37	16	28	32

STERLING MONEY.

£	s.	d.
6)82	14	6
13	15	9

£	s.	d.
8)143	7	10
17	18	5½

£	s.	d.
7)78	10	11

£	s.	d.
9)98	17	1

£	s.	d.
19)36	16	3

£	s.	d.
(1	18	9

6 Divide 112£ 13*s.* 4*d.* by 31. What is the quotient?
Ans. 3£ 13*s.* 4*d.*

7 Divide 189£ 14*s.* by 95. Quotient, 1£ 19s. 11*d.*+

PROMISCUOUS EXERCISES

1 In 35 dollars how many cents? Ans. 3500.
2 How many miles are there in 98 furlongs?
Ans. 12M. 2fur.
3 How many weeks are there in 365 days?
Ans. 52we. 1 da.
4 In 84 half cents how many cents? Ans. 42 cts.
5 In 8 tons 15 cwt., how many hundred weight?
Ans. 175 cwt.
6 How many perches are there in 63 roods?
Ans. 2520 square per.
7 How many pounds in 157*s.*? Ans. £7 17*s.*
8 In 175 pecks how many bushels? Ans. 43bu. 3pe.
9 In 7642 cents how many dollars? Ans. $76 42cts
10 In 103 pints how many quarts? Ans. 51qt. 1pt.
11 How many minutes are there in 720 seconds?
Ans. 12min.
12 In 7 hogsheads, 33 gallons, how many gallons?
Ans. 474 gal.

PROPORTION;

OR

THE SINGLE RULE OF THREE.

In comparing two quantities of the same kind, the quotient which arises by dividing the second by the first, is called the RATIO of the first to the second; thus, in comparing 4 and 12, we say the ratio of 4 to 12 is 3; the ratio of 2 to 8 is 4; the ratio of 3 to 15 is 5. The two quantities compared are called the TERMS of the ratio, the first quantity being called the ANTECEDENT and the second the CONSEQUENT, thus, in comparing 4 and 12, we call 4 the antecedent, and 12 the consequent; 4 and 12 are also called the terms whose ratio is 3.

When there are four numbers, such that the quotient of the second divided by the first is the same as the quotient of the fourth divided by the third, that is, so that the ratio of the first to the second is the same as the ratio of the third to the fourth, we say that these four numbers are in PROPORTION. The first and last terms are called EXTREMES; the second and third terms are called MEANS. Thus, we say the numbers 2 & 4, and 5 & 10 form a proportion, because the ratio of 2 to 4 is the same as the ratio of 5 to 10. Numbers in proportion are written thus:

2 : 4 :: 5 : 10 which is read,

2 is to 4 as 5 is to 10.

The numbers 2 and 10 are called the extremes, and the numbers 4 and 5 the means.

Simple proportion may then be defined to be the equality of the ratio of two quantities to that of two other quantities, and the object of the SINGLE RULE OF THREE is, having three terms of a proportion given to find the fourth. In every proportion the first and second terms must be of the same kind, and the fourth must be of the same kind as the third, for there can only be a ratio between things of the same kind, thus we say the ratio of 2 inches to 6 inches is 3; on the contrary there is no ratio between 2 inches and 6 hogs.

In every case of proportion the pupil will observe that the *product of the means is equal to the product of the extremes*, and it is from this fundamental law that the rule for the solution in the single rule of three is derived. In the following proportions the pupil will perceive that in every case the product of the means is equal to the product of the extremes.

As 2 : 4 :: 6 : 12
2 : 8 :: 5 : 20
3 : 5 :: 6 : 10
7 : 11 :: 14 : 22

Now suppose that we had the three first terms given and it were required to find the fourth; it is evident that the fourth term must be such that when multiplied by the first, the product shall be equal to the product of the second and third terms, hence if we divide the product of the second and third terms by the first term, we shall get the fourth term. In this manner let the fourth term be found in each of the following proportions.

2 : 4 :: 8 is to what? *Ans.* 16.
3 : 11 :: 9 is to what? *Ans.* 33.
4 : 6 :: 6 is to what? *Ans.* 9.
2 : 9 :: 8 is to what? *Ans.* 36.
5 : 7 :: 15 is to what? *Ans.* 21.

The application of the principles of proportion to the solution of questions may be illustrated by the following simple question.

If 2 oranges cost 5 cents, what will 8 oranges cost?

Now here we have given three numbers or terms, two of which are of the same kind and the other is different; the ratio of 2 oranges to 8 oranges is 4, hence the ratio of the price of 2 to the price of 8 must also be 4, that is since eight oranges, is 4 times 2 oranges, the price of 8 oranges must be 4 times the price of 2, that is 4 times 5 cents, or 20 cents. If we arrange these numbers in the form of a proportion, they will stand thus:

O O cts.
As 2 : 8 :: 5 That is, As 2 oranges are to 8 oranges, so are 5 cts to a fourth term which will be the cost of 8 oranges, this fourth term is found as in the

eceding examples, by multiplying 5 by 8 and dividing
2 which gives 20 cts for the answer. By carefully
idying the preceding remarks, the pupil will under-
and the following rule.

RULE FOR THE STATEMENT.

Place the number that is of the denomination in which
e answer is required in the THIRD PLACE. When from
e nature of the question the answer ought to be *greater*
an the *third* term, place the *greater* of the two re-
aining terms in the *second place*, and the other in the
st.

When from the nature of the question the answer
ght to be *less* than the *third term*, place the *less* of the
o remaining terms in the *second place*, and the other
the *first.*

RULE FOR THE SOLUTION.

When the question is thus stated, if the first and sec-
l terms be not of the same denomination, reduce one
both of them till they are; and if the third term con-
s of several denominations, reduce it to the lowest.
Then multiply the *second* and *third* terms together,
divide the product by the *first* term, the quotient
be the answer or fourth term.

NOTE.—The answer will be of that denomination to
ch the third term is reduced, and if it is not in the
omination required it may be brought to it by re-
ion.

Examples to show the method of stating.

If four pounds of sugar cost 50 cents, what will 24
ds cost at the same rate?

rm.	*2dTerm.*	*3dTerm.*
	lbs.	*cts.*
:	24	:: 50

In this question the answer is required to be money: therefore *money* (the 50 cts.) must be in the *third place.* Because 24 pounds will cost *more* than 4 pounds—the *greater* (24 lbs.) must occupy the *second place:* and the remaining term (4 lbs.) the *first.*

2 If 24 pounds cost 300 cents (or 3 dollars;) how ıny pounds may be purchased for 50 cents at the same :e?

cts.		*cts.*		*lbs.*
300	;	50	::	24

In this question the answer is required to be in *pounds;* therefore *pounds* (the 24) must be in the *third place.*

Because 50 cts will purchase *less* than 300 cts.—the *less* (50 cts.) must occupy the *second place:* and the remaining term (300 cts.) the *first.*

Examples to show the method of solution.

If 3 yards, 8 feet of plastering cost 1 dollar and 40 nts, what will be the price of 16 yards?

Ans. 5 dol. 76 cts.

yd. ft.		*yd.*		*D.cts.*
3 - 8	:	16	::	1,40
9		9		
35		144		
		140		
		5760		
		144		

35)20160(576 cts.
175
266
245
210
210
...

Here the *first* and *second* terms are not alike; that is they are not both yards, nor both feet, then they must both be reduced till they are alike.

The third term dollars and cents, must be reduced to cents.

Now multiply the second and third terms together; and divide the product by the first term, and the quotient will be the answer in cents.

Reduce the cents to dollars for the answer.

2 How many yards of cloth can be purchased for 95 dollars, if 4 yd. 3 qr. cost $9,50 ?

Ans. 47 yd. 2 qr. ; or 47½ yd.

$ ct.	$ ct.	yd. qr.
As 9,50 :	95,00 ::	4 - 3
	19	4
	85500	19
	9500	
950)180500(190 qrs.		
	950	
	8550	
	8550	
	0	

Because there are cents in the first term, the 95 in the second term must be reduced to cents. *Add* 2 *cyphers*. Because there are quarters in the third term, it must be reduced to quarters.

Because the third term is reduced to quarters; the answer (190) is in quarters, which must be reduced to yards.

qr.
4)190

47 yd. 2 qr.

3 If 6 horses eat 21 bushels of oats in a given time; how much will 20 horses eat in the same time ?

Ans. 70 bu.

4 If 20 horses eat 70 bushels of oats in a certain time; how much will 4 horses eat in the same time ?

Ans. 14 bu.

5 If a family of ten persons use 7 bushels, 3 pecks of wheat in a month; how much will serve them when there are 30 in the family ?

Ans. 23 bu. 1 pe.

6 If 14 lbs of sugar cost 75 cents, how many pounds can be bought for three dollars ?

Ans. 56 lbs.

7 If 4 hats cost 12 dollars, what will 27 hats cost at the same rate ?

Ans. $81.

If 20 yards of cloth cost $85, what will 324 yards t at the same rate?

Ans. $1377.

If 2 gallons of molasses cost 70 cents, what will 2 gsheads cost? Ans. $44,10.

0 If 1 yard of cloth cost $3,25 cts., what will be the st of 6 pieces, each containing 12 yds. 2 qrs.?

Ans. $243,75 cts.

1 If 3 paces or common steps of a person be equal to yards, how many yards will 160 paces make?

Ans. 106 yds. 2 ft.

2 If a person can count 300 in 2 minutes, how many n he count in a day? Ans. 216000.

3 What quantity of wine at 60 cts. per gallon can be ught for $37,80 cts. Ans. 63 gal.

14 If 8 persons drink a barrel of cider in 10 days, how any persons would it require to drink a barrel in 4 days?

Ans. 20.

15 If 8 yards of cloth cost $12, what will 32 yards ost? Ans. $48.

16 If 3 bushels of corn cost $1,20, what will 13 bushels cost? Ans. $5,20.

17 If 9 dollars will buy 6 yards of cloth, how many ards will 30 dollars buy? Ans. 20.

18 If a man drink 3 gills of spirits in a day, how much vill he drink in a year? Ans. 34 gal. 1 pt. 3 gi.

19 If 12 horses eat 30 bushels of oats in a week, how nany bushels will serve 44 horses the same time?

Ans. 110.

20 If a perpendicular staff 6 feet long, cast a shadow 5 feet 4 inches, how high is that tree whose shadow is 104 feet long at the same time? Ans. 117 feet.

EXERCISES.

1 If 12 acres, 2 roods, produce 525 bushels of corn, how many bushels will 62 acres, 2 roods produce?

Ans. 2625 bu.

2 If 7 men plough 6 acres, 3 roods in a certain time, how many acres will 96 men plough in the same time?

Ans. 92 A. 2 R. 11 Per. 12 yd.+

3 Suppose 3 men lay 9 squares* of flooring in 2 days; how many men must be employed to lay 45 squares in the same time? Ans. 15 men.

4 If 7 pavers lay 210 yards of pavement in one day; how many pavers would be required to lay 120 yards in the same time? Ans. 4 pavers.

5 If 2 hands saw 360 square feet of oak timber in 2 days; how many feet will 8 hands saw in the same time? Ans. 1440 feet.

6 An engineer having raised a certain work one hundred yards in 24 days, with 5 men; how many men must be employed to perform a like quantity in 15 days? Ans. 8 men.

7 If 3 paces or common steps be equal to 2 yards; how many yards will 160 such paces make? Ans. 106 yd. 2 ft.

8 If a carriage wheel in turning twice round, advance 33 feet 10 inches; how far would it go in turning round 63360 times? Ans. 203 miles.

9 Sound flies at the rate of 1142 feet in 1 second of time; how far off may the report of a gun be heard in 1 minute and 3 seconds? Ans. 13 miles, 5 fur., 0 poles, 2 yd.

10 If a carter haul 100 bushels of coal at every 3 loads; how many days will it require for him to load a boat with 3600 bushels, suppose he haul 9 loads a day? Ans. 12 days.

bu.	*bu.*	*da.*	*da.*
As 300	: 3600	: : 1	: 12.

11. If 8 men can reap a field of wheat in 4 days; how many days will it require for 16 men to do it? Ans. 2 days.

12 Sold 10 yards of linen at 5 dollars 50 cents; what was it a yard? Ans. 55 cents.

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*A SQUARE is 10 feet long and 10 feet wide, or 100 square feet. This measure is employed in estimating the quantity of flooring, roofing, weather-boarding, &c.

13 If 7 pounds of cheese cost 87½ cents; what must I pay for 122 pounds? Ans. 15 dol. 25 ct.

14 If 1 ounce of silver cost 72 cents; what will 3 pounds 5 ounces come to? Ans. 29 dol. 52 ct.

Why do you multiply the second and third terms together and divide by the first?

What will 24 pounds of bacon cost at 50 ct. for every 4 pounds?

lb. lb. ct. ct.
As 4 : 24 :: 50 : 300

cts.
4) 50

12½ the price of 1 lb.
24

50
25

300 ct. the price of 24 lb.

If 4 pounds cost 50 cents, divide the 50 cents by 4, gives the price of 1 pound: thus 4 into 50 12½. If 1 pound cost 12½ cents, 2 pounds will cost twice that; three pounds three times, and 24 pounds will cost 24 times 12½ ct.; that is 300 cts. or 3 dol.

If the second and third terms be multiplied together, and their product divided by the first, the result will be the same as it is when the third is divided by the first, and the quotient multiplied by the second.

15 If 15 yards of broad cloth cost 80 dollars; what will 75 cost. Ans. 400 dollars.

16 A man bought 1¼ yards linen for $2 50 cts.; what is the worth of 1 qr. 2 na. at the same rate.
Ans. 62½ ct.

17 If 321 bushels of salt cost $240 75 cents; what was it per bushel? Ans. 75 cents.

18 If the moon move 13 deg. 10 min. 35 sec. in one day; in what time does it perform one revolution?
Ans. 27 da. 7 hrs. 43 min.

deg. min. sec. deg. da.
As 13 10 35 : 360 :: 1

19 If a staff 4 feet long, cast a shade 7 feet on level ground; how high is a steeple whose shade is at the same time 198 feet. Ans. 113½.

20 If a man's annual income be 1333 dollars, and he spend 2 dollars 14 cents a day; what will he save at the end of one year? Ans. $551 90 ct.

21 Suppose A. owes B. 791 dols. 60 ct., and can pay only 37½ cts. on the dollar; how much must B. receive? Ans. $296 85 ct.

22 Bought 3 casks of raisins, each containing 3 cwt. 1 qr. 14 lb.; how much did they cost at $6 21 ct. per cwt.? Ans. $62,87½

PROPORTION—DIRECT AND INVERSE.

Hitherto, proportion has been treated in general terms; it now remains to consider the two kinds, DIRECT and INVERSE.

DIRECT PROPORTION is that in which *more* requires *more*, or LESS requires LESS. Thus:

yd. yd. dol. As 2 : 124 : : 4	If 2 yd. cost 4 dol., 124 yd. being *more* than 2 yd., will cost *more* than 4 dol.
yd. yd. dol. As 124 : 2 : : 248	And, if 124 yd. cost 248 dol.; 2 yd. being *less* will cost *less*. That is, *more* yards require *more* money, and *less* yards cost *less* money

INVERSE PROPORTION is that in which *more* requires *less;* and *less* requires *more.* Thus:

If 12 men built a wall in 4 days; how many men can do it in 8 days?	It is supposed that 12 men perform a piece of work in 4 days: a like piece of work is to be done in 8 days; this will require a *less* number of men: that is, *more* days require *less* men.
STATED. *da. da. m. m.* As 4 : 8 inversely : : 12 : 6 OR: *da. da. m. m.* As 8 : 4 directly : : 12 : 6	Here it is supposed that 12 men performed a piece of work in 8 days: a like piece is to be done in 4 days; this will require *more* men. That is, *more* days require *less* men, and *less* days require *more* men.

All the past exercises in proportion are *Direct*—the following will be

INVERSE PROPORTION.

Questions in *Inverse Proportion*, may be stated and solved by the same rule that is given for Direct Proportion.

EXERCISES.

1 If 6 mowers mow a meadow in 12 days; in what time will 24 mowers do it? Ans. 3 da.

2 If a man perform a journey in 6 days, when the days are 8 hours long; in what time will he do it when they are 12 hours long? Ans. 4 da.

3 If, when wheat is 83 cents a bushel, the cent loaf weighs 9 ounces; what ought it to weigh when wheat is $1 24 cts. a bushel? Ans. 6 oz.

4 If 100 dollars principal in 12 months gain 6 dollars interest; what principal will gain the same interest in 8 months? Ans. $150.

5. If 12 inches long and 12 inches wide, make 1 square foot; how long must a board be that is 9 inches wide, to make 12 square feet? Ans. 16 ft.

6 A. lent B. 500 dollars for 6 months; how long must B. lend A. 220 dollars to be equivalent?

Ans. 13 months, 19 days.*

7 There is a cistern having a pipe that will empty it in 12 hours; how many pipes of the same capacity will empty it in 15 minutes? Ans. 48 pipes.

8 A certain building was raised in 8 months by 120 workmen, but the same being demolished, it is required to be rebuilt in 2 months; how many workmen must be employed? Ans. 480 men,

9 If for 48 dollars 225 cwt. be carried 512 miles; how many hundred weight may be carried 64 miles for the same money? Ans. 1800 cwt.

*A month is estimated at 30 days, unless a particular month be referred to.

10 If 48 men can build a wall in 24 days; how many men can do it in 192 days? Ans. 6 men.

11 How many yards of carpeting 2 ft. 6 in breadth, will cover a floor that is 27 feet long and 20 feet wide? Ans. 72.

12 What quantity of shalloon that is 3 quarters wide, will line 7½ yards of cloth that is 1¼ yd. wide? Ans. 15 yd.

13 How many yards of matting that is 3 quarters wide, will cover a floor that is 18 feet wide and 60 feet long? Ans. 160.

14 In what time will $600 gain the same interest that $80 will gain in 15 years? Ans. 2 years.

Questions.

What is proportion?

When is the proportion *direct?*

When is it *inverse?*

Why is the proportion *inverse* in the last question?

A. because it is *more* money requiring *less* time.

Why is the proportion inverse in the 11th question?

A. because the shalloon is *narrower* than the cloth; that is *less* width requiring *more* length.

Why is the 10th question *inverse?*

PROMISCUOUS EXERCISES.

1 A certain steeple standing upon level ground, casts a shadow to the distance of 633 feet 4 inches, when a staff 3 feet long, perpendicularly erected, casts a shadow of 6 feet 4 inches; what is the height of the steeple? Ans. 300 ft.

2 A ship's company of 15 persons is supposed to have bread enough for a voyage, allowing each person 8 ounces a day, when they take up a crew of 5 persons, with whom they are willing to share; what will be the daily allowance of each person now? Ans. 6 oz.

3 Bought 215 yards of broad cloth at 6 dollars a yard;

what was the prime cost, and how must I sell it per yard to gain $135 on the whole.

Ans. prime cost $1290,00; to be sold for $6,62½ per yard.

4 If 100 men can complete a piece of work in 12 days how many can do it in 3 days? Ans. 400 men

5 If a board be 4½ inches wide; how long a piece will it take to make 1 square foot? Ans. 32 in

6 A pole, whose height is 25 feet, at noon casts a shadow to the distance of 33 feet 10 inches; what is the breadth of a river which runs due East at the bottom of a tower 250 feet high, whose shadow extends just to the opposite edge of the water? Ans. 338 ft. 4 in

7 A plain of a certain extent having supplied a body of 3000 horses with forage for 18 days; how long would it have supplied 2000 horses? Ans. 27 da

8 A piece of ground 1 rod wide and 160 rods long makes 1 acre; how wide a piece must I have across the end of a farm 32 rods wide to make an acre?

Ans. 5 rods

9 I have a floor 24 feet long and 15 feet wide, which I wish to cover with carpeting that is 3 quarters of a yard wide; how many yards must I buy.

Ans. 53 yards, 1 foot

10 How much land at $2,50 an acre must be given in exchange for 360 acres worth $3,75 an acre?

Ans. 540 acres

11 What is the weight of a pea to a steel-yard, which is 39 inches from the centre of motion, will balance a weight of 208 lbs., suspended at the draught end 3 quarters of an inch? Ans. 4 lb

12 If $28 will pay for the carriage of 6 cwt. 150 miles; how far should 24 cwt. be carried for the same money? Ans. 37½ miles

COMPOUND PROPORTION;
OR
THE DOUBLE RULE OF THREE.
DIRECT AND INVERSE.

COMPOUND PROPORTION is two or more series of proportionals combined.

Five, seven, nine, or other odd number of terms, is always given to find a sixth, eighth, or tenth, &c., or answer.

Rule for the Statement.

Place the numbers that is of the denomination in which the answer is required to be, in the *third place*. Then:

Consider separately each pair of similar terms and place them agreeably to the rule for SIMPLE PROPORTION.

OR,

Work by two separate statements in simple proportion.*

Rule for the Solution.

Reduce the several pairs of terms to similar denominations as in single proportion, and the last to the lowest denomination given: Then

Multiply the two *initials*, or left hand terms together for a DIVISOR, and the other three for a DIVIDEND.

Divide the *latter* by the *former*, and the quotient will be the answer, in that denomination to which the *third term* was reduced.

EXAMPLES.

1. If 6 men in 8 days build 40 rods of wall, how much will 18 men build in 20 days? Ans. 300 rods.

* It would be well for the pupil to work each sum both ways.

Men		men		
As 6	:	18		rods
da.		da.	: :	40
As 8	:	20		

48)14400(300
144
00

The answer is required to be given in rods: then *rods* must be the *third* term. If 6 men build 40 rods, 18 men will build *more*; then more (18 men) must occupy the *second*, and *less* (6 men) the first place.

If 8 days produce 40 rods, 20 days will produce *more;* then *more* (20 days) must occupy the *second*, and *less* (8 days) the *first* place.

N. B. The first pair, or two upper terms must be alike. Also the lower pair must be alike.—That is, both must be *men* or both *days*, both hours or both bushels, &c.

2. If 6 men in eight days eat 10lb. of bread, how much will 12 men eat in 24 days? Ans 60.

men 6 : 12 }
days 8 : 24 } : : 10 lb.

48)2880(60 Ans.
288
0

Contracted.

6 : 12 2 }
8 : 24 3 } : : 10lb.

6
10
60 Ans.

3. Suppose 4 men in 12 days mow 48 acres, how many acres can 8 men mow in 10 days? Ans. 128A.

4. If 10 bushels of oats be sufficient for 18 horses 20 days, how many bushels will serve 60 horses 36 days, at that rate? Ans. 60bu.

5. Suppose the wages of six persons for 21 weeks be 288 dollars, what must 14 persons receive for 46 weeks? Ans. $1472.

6. If the carriage of 8cwt. 128 miles cost $12.80, what must be paid for the carriage of 4cwt. 32 miles? Ans. $1.60.

7. If 37lb. of beef be sufficient for 12 persons 4 days, how many lb. will suffice 38 men 16 days?

Ans. 468lb. $10\frac{2}{3}$ oz.

8. If a man can travel 305 miles in 30 days, when the days are 14 hours long, in how many days can he travel 1056 miles, when the days are $12\frac{1}{2}$ hours long?

Ans. 116 days.+2540.

9. If the carriage of 24cwt. for 45 miles be 18 dollars, how much will it cost to convey 76cwt. 121 miles?

Ans. $153 26 cts.+720.

10. A person having engaged to remove 8000cwt. in 9 days; removed 4500cwt. in 6 days, with 18 horses: how many horses will be required to remove the balance in the remaining 3 days? Ans. 28 horses.

11. If 3 men reap 12 acres 3 roods in 4 days 3 hours, how many acres can 9 men reap in 17 days?

Ans. 153 acres.

men	men		
3	9	a.	r.
d.	d.	12	3
4	17	4	
12*	12	—	
—	—	51	
51	204		
3	9		
—	—		
153	1836		
	51		
	—		
	1836		
	9180		
	—		

153)93636(612 roods, or 153 acres
918
183
153
306
306
...

Analysis.

If 3 m. reap 12 a. 3 r.
1 m. rea 4 a. 1 r. and
9 m. reap 38 a. 1 r.

If 4 d. 3h. reap 38 a.
1 r. 1 d. reap 9 a. and
17 d. reap 153 a. Ans.

*The day is here estimated at twelve hours.

12. If 40 men build 32 rods of wall in 8 days, working 10 hours each day; in how many days will 60 men build 48 rods, working 12 hours a day?

Ans. 6 days, 8 hours.

Men	men	
60 :	40	Multiply all the initial terms (or 60, 32, and 12)
rods	rods	days together for a *divisor:* and
32 :	48	: : 8 the other four for a *dividend.*
hours	hours	
12 :	10	

13. If 36 men dig a cellar 60 feet long, 24 feet wide, and 8 feet deep, in 16 days, working 16 hours per day, how many men can dig a cellar 80 feet long, 40 feet wide, and 12 feet deep, in 20 days, working 12 hours per day? Ans. 128.

Questions.

What is *compound proportion?*
How do you state questions in compound proportion?
Which terms do you multiply together for a *divisor?*
Which for a *dividend?*
What other method is there?

PRACTICE.

PRACTICE is a short and expeditious method of performing various calculations in business.

CASE 1.

When the given price is LESS *than one dollar.*

RULE.—Set down the given number as one dollar, and take such *aliquot part** or parts of that number, as the price is of one dollar, for the answer.

*An aliquot part of a number is any number that will divide it without a remainder; thus 4 is an aliquot part of 20; and 8 of 40; and 25 cents is an aliquot part of 100 cents, (or $1.) because 25 cts. are contained in 100 cts., an even number of times, without a remainder.

TABLE OF ALIQUOT PARTS.

CTS.			CWT.			ROODS.		
50	$\frac{1}{2}$	of a dollar	10	$\frac{1}{2}$	of a ton	roods		of an acre
$33\frac{1}{3}$	$\frac{1}{3}$		5	$\frac{1}{4}$		2	$\frac{1}{2}$	
25	$\frac{1}{4}$		4	$\frac{1}{5}$		1	$\frac{1}{4}$	
20	$\frac{1}{5}$		2	$\frac{1}{10}$				
$12\frac{1}{2}$	$\frac{1}{8}$		1	$\frac{1}{20}$		perches		
10	$\frac{1}{10}$		qr.		of a cwt.	20	$\frac{1}{8}$	
$6\frac{1}{4}$	$\frac{1}{16}$		2	$\frac{1}{2}$		10	$\frac{1}{16}$	
5	$\frac{1}{20}$		1	$\frac{1}{4}$		20	$\frac{1}{2}$	of a rood
4	$\frac{1}{25}$		lbs.			10	$\frac{1}{4}$	
2	$\frac{1}{50}$		16	$\frac{1}{7}$		8	$\frac{1}{5}$	
			14	$\frac{1}{8}$		5	$\frac{1}{8}$	
			8	$\frac{1}{14}$		4	$\frac{1}{10}$	
			7	$\frac{1}{16}$		2	$\frac{1}{20}$	

EXAMPLES.

1. What will 826 bushels of wheat come to at 25 cts. a bushel? Ans. $206 50 cts.

cts.		$
25	$\frac{1}{4}$	826
	$	206,50

826 bushels, at one dollar a bushel, will cost 826 dollars: at 25 cents, or $\frac{1}{4}$ of a dollar, it will cost one fourth as much.

2. What will 934 gallons of molasses cost, at 50 cts. a gallon? Ans. $467.

cts.		$
50	$\frac{1}{2}$	934
	$	467

3. What will 1832 bushels of salt cost, at 75 cents a bushel? Ans. $1374.

cts.		$
50	$\frac{1}{2}$	1832
25	$\frac{1}{2}$	
		916 cost at 50 c.
		458 cost at 25 c.
		$1374 cost at 75 c.

At 50 cents the cost will be $\frac{1}{2}$ as much as—at one dollar.
At 25 cents the cost will be $\frac{1}{2}$ as much as—at 50 cts.

cts.		$
50	½	1832
25	¼	
		916 ct. at 50.
		458 ct. at 25.
		$1374 ct. at 75.

As before; the cost at 50 cts. will be ½ as much as—at 1 dollar.
At 25 cts. it will be ¼ as much as—at 1 dollar.

4. What will 680 pounds of sugar cost, at 10 cents a und? $68.

5. What will 742 pounds of pork cost, at 6¼ cts. a und? Ans. $46 37½ cts.

6. What must I pay for 371 pounds of bacon, at 12½ s. a pound? Ans. $46 37½ cts.

7. How much will 8750 bushels of rye cost, at 62½ s. a bushel? Ans. $5468 75 cts.

8. How much must be paid for 4360 square feet of arble, at 87½ cents a foot? Ans. $3815.

9. What will 468 square yards of plastering cost, at 3¾ cents a yard? Ans. $87 75 cts.

10. How much will be the cost of laying 856 perches stone, at 93¾ cents a perch? Ans. $802 50 cts.

11. What will the digging of a cellar, containing 180 ubic yards, cost, at 20 cents a yard? Ans. $36.

12. What will be the cost of hauling 248 cords of ood, at 31¼ cents a cord? Ans. $77 50 cts.

13. What must be paid for 432 perches of stone, at 7½ cts. a perch? Ans. $162.

14. How much must be given for 724 days labor, at 3¾ cents a day? Ans. $407 25.

5.	What will 742 bushels cost at	10 cts.	Ans. $74 20
3.	732	15	109 80
7.	732	20	146 40
3.	475	25	118 75
9.	684	30	205 20
0.	756	35	264 60
1.	927	40	370 80
2.	824	50	412 00
3.	682	55	375 10
4.	341	60	204 60
5.	784	[illegible]0	548 80

28. What will	352 bushels cost at	6¼ cts.?	Ans. $22 00.
29.	436	12½	54 50
30.	724	18¾	135 75
31.	956	31¼	298 75
32.	742	37½	278 25
33.	274	43¾	119 87½
34.	732	56¼	411 75
35.	845	62½	528 12½
36.	684	68¾	470 25
37.	274	81¼	222 62½
38.	386	93¾	361 87½

Case 2.

When the given price is MORE *than one dollar.*

Rule.—Multiply the given sum by the number of dollars, and take the aliquot part or parts for the cents, as in Case 1.

Examples.

1. What will 342 cords of wood cost, at 3 dollars 75 cents a cord? Ans. $1282 50.

cts.		$
50	½	342
		3
		1026
25	½	171
		85 50
		1282 50

342 cords at $1, will cost $342; at $3 it will cost 3 times $342; at 50 cts. it will cost ½ as much as it will at $1.; and at 25 cents, ¼ as much as it will at 50 cts.; which added together, will be the cost at $3 75.

2. What will	250 acr. cost at	$4 62½	Ans. $1156 25
3.	435	5 87½	2555 62½
4.	273	6 12½	1672 12½
5.	942	7 37½	6947 25
6.	846	3 68¾	3119 62½
7.	957	5 75	5502 75
8.	236	6 93¾	1637 25
9.	754	3 56¼	2686 12½
10.	932	27 25	25397 00

CASE 3.

When the given quantity consists of several denominations.

RULE.—Multiply the given price by the number of hundred weight, acres, yards, or pounds, &c. and take the aliquot parts for the quarters, roods, feet, or ounces, &c.

EXAMPLES.

1. What will 240 acres, 2 roods, 10 perches, cost at $15 25 cents an acre? Ans. $3668 57½ cts.

		$
		1525
		240
		61000
		3050
2 r.	½	762½
10 p.	⅛	95¼ + 2 rem.
		366857½

2. What will 29 yards, 4 feet, of stone pavement cost, at $2 25 cents a yard? Ans. $66 25 cts.

		$
		225
		29
		2025
		450
3 square feet	⅓	75
1	⅓	25
		6625

3. What will 32 pounds 8 ounces of silver cost, at $15,62½ a pound? Ans. $510 41½.

6 oz. Troy	½	$15 62½
		32
		16
		3124
		4686
2 oz.	⅓	781½
		260½ + 2Rem.
		510 41½

4. What will 27 cwt. 3 qrs. cost, at $23 50 cts. a cwt.? Ans. $652 12½.

5. What will be the cost of 47 lb. 10 oz. (Troy) at $1 25 cts. Ans. $59 79.

6. What will 64 yds. 3 qrs. cost, at $2 25 a yard? Ans. $145 68¾.

7 Sold 83 yards 2 qrs. of cloth at $10 50 a yard; what does it amount to? Ans. $876 75.

8. What will the laying of 28 squares, 75 feet of flooring cost, at $2 25 cts. a square? Ans. $64 68¾.

9. What is the cost of 27 cords, 96 feet of fire wood, at $3 75 a cord. Ans. $104 06¼

10. What is the value of 428 gals. 3 qts. at $1 40 cts. a gallon? Ans. $600 25 cts.

11. What is the value of 765 gals. 3 qt. 1 pt. at $2 18¾ cents a gallon? Ans. $1675 34¼ cts.

12. What is the value of 5 hhds. 31½ gals. at $47 12 cts. a hogshead? Ans. $259 16 cts.

13. What is the value of 17 hhds. 15 gals. 3 qts. at $64 75 cts. per hogshead? Ans. $1116 93 cts. 7m.

14. What is the value of 120 bu. 2 pecks, at 35 cents a bushel? Ans. $42 17 cts. 5 m.

15. What is the value of 780 bu. 2 pecks, 2 qts. at $1 17 cts. a bushel? Ans. $913 25 cts.+

16. What is the value of 1354 bu. 1 peck, 5 qts. 1 pt. at 25 cts. a bushel? Ans. $338 60 cts. 5m.+

17. What is the value of 35 acres 2 roods 18 perches, at 54 dollars 35 cts. an acre? Ans. $1935 53 cts. 9m.

Questions

What is *practice?*
What is the rule for the solution of questions in practice?
What is an aliquot part?
Are 50 cts. an aliquot part of 100 cents?
What part of $1 is fifty cents?
What part of $1 is 33⅓ cents?
What part of $1 is 25 cents?
What part of $1 is 12½ cents?
What part of $1 is 10 cents?
What part of $1 is 20 cents?
What part of $1 is 5 cents?
What part of $1 is 4 cents?
What part of $1 is 6¼ cents?

TARE AND TRET.

TARE AND TRET are allowances made on the weight of some particular commodities.

Gross weight is the weight of the goods, together with the vessel that contains them.

Tare is an allowance for the weight of the vessel.

*Tret** is an allowance of 4 lb. for every 104, for waste, &c.

Neat weight is the weight of the goods, after all allowances are made.

RULE.

Subtract the *tare* from the *gross*, and the remainder is the *neat weight.*

EXAMPLES.

1 Bought a chest of tea, weighing gross 63 lb., tare 8 lb.—what are the neat weight and value, at 85 cents per lb?

*A tret is never regularly allowed in this country; no account of it is taken in this work.

lb.	85 *ct.*
63 gross—or, weight of the chest and tea	55 *lb.*
8 tare—or, weight of the chest	
	425
55 neat—or, weight of the tea itself	425

$46,75 value.

2 Bought 5 bags of coffee, weighing each 97 lb. gross, tare of the whole 7 lb.—what are the neat weight and value, at 25 cents per lb.? Ans. 478 lb. neat—$119,50.

3 The gross weight of a hogshead of sulphur is 1344 lb.; the tare 138 lb.—what are the neat weight and its value, at $4,75 per 100 lb.?

Ans. 1206 lb. neat—$57,28½.

4 Bought 3 barrels of sugar, weighing as follows, viz: 236 lb. gross, 23 lb. tare—217 lb. gross, 22 lb. tare—225 lb. gross, 23 lb. tare—what are the neat weight and value, at $8 per 100 lb.? Ans. 610 lb. neat—$48,80.

5 Sold 3 hogsheads of sugar, weighing each 12 cwt. 2 qrs. 14 lb. gross; tare 2 cwt. 1 qr. 27 lb.—what are the neat weight and value, at $11,50 per cwt.?

Ans. 35 cwt. 1 qr. 15 lb. neat—$406 91½ cts.

6 What is the neat weight of 15 tierces of rice, weighing 48 cwt. 3 qrs. 12 lb. gross; tare 6 cwt. 12 lb., and what is the value, at $5,25 per cwt.?

Ans. 42 cwt. 3 qrs. neat—$224,43¾.

7 What is the neat weight of 28 hogsheads of tobacco, weighing 201 cwt. 3 qrs. 12 lb. gross; tare 3140 lb.; and what does it come to at $5 per cwt.?

Ans. 173 cwt. 3 qrs. 8 lb—$869 10¼ cts.

8 Bought 17 bags of grain, weighing 3561 lb. gross; tare 2 lb. per bag—what is the neat? Ans. 3527 lb.

9 What is the neat weight of 16 bags of pepper, each weighing 65 lb. gross; tare 1½ lb. per bag—and what is the amount at 30 cents per lb.?

Ans. 1016 lb. neat—$304,80.

10 In 14 hogsheads of sugar, weighing 89 cwt. 3 qrs. 17 lb. gross; tare 100 lb. per hhd.—how much neat weight, and what is its value, at $9 per cwt.?

Ans. 77 cwt. 1 qr. 17 lb. neat—$696,61½.

11 What are the neat weight and value of 16 hhds. of tobacco, each weighing 5 cwt. 1 qr. 19 lb. gross; tare 101 lb. per hhd., at £2 6s. 10d. per cwt.?

Ans. 72 cwt. 1 qr. 4 lb. neat—£169. 5s. 4½d.

12 Bought 6 hhds. of sugar, each 1126 lb. gross; tare 117 lb. per hhd.—what are the neat weight and value at $8,75 per cwt.? Ans. 6054 cwt. $529,72½.

13 What are the neat weight and cost of a hogshead of sugar weighing gross 986 lb.; tare 12 per cent, (or 12 lb. for every 100 lb.) at $8 per neat hundred pounds?

lb. lb. lb. lb.	*lb. lb. lb. lb.*
As 100 : 986 :: 12 : 118,32	Or as 100 : 88 :: 986 : 867,68
lb.	*lb.*
986 gross.	86768
118,32 tare.	8 dol.
867,68 neat weight.	$69,4144 the value.

14 What are the neat weight and value of 4 hhds. of sugar weighing gross 4500lb. tare 12 lb. per cent. at $8, 75 per cent.? Ans. 3960 lbs. neat —$346,50.

15 Bought 10 hhds. of sugar, each 920 lb. gross; tare 10 lb. per cent.—what are the neat weight and value at $9,25 per cwt.? Ans. 8280 lb. neat—$765,90.

16 Sold 3 casks of alum, each 675 lb. gross; tare 13 lb. per cent.—what are the neat weight and value at $4, 25 per cent. Ans. 1761,75 lb. neat—$74,87.4375.

Or, 1761¾ lb. neat—$74,87¼ nearly.

17 What is the neat weight of 4800lb. gross: tare 12 lb. per cent.? Ans. 4224 lb.

18 What are the neat weight and value of 4 hhds. of sugar, each 12 cwt. 1 qr. 14 lb. gross; tare 12 lb. per cwt. at $12,20 per cwt.?

Ans. 44 cwt. 22 lb neat—$539 19¼ cts.

19 Bought 17 hhds. of sugar, weighing 201 cwt. 2 qrs. 13 lb. gross; tare 10 lb. per cwt.—what are the neat weight and value at $14 per cwt.?

Ans. 183 cwt. 2 qrs. 13 lb. neat— $2570 62½ cts.

INTEREST.

INTEREST is an allowance made for the use of money.

Principal is the sum for which interest is to be computed.

Rate per cent. per annum is the interest of 100 dollars for one year.

Amount is the principal and interest added together.

CASE 1.

When the time is one year and the rate per cent. is any number of dollars.

RULE.—Multiply the principal by the rate per cent., and divide by 100; the quotient will be the interest for one year.

EXAMPLES.

1. What is the interest of 500 dollars for 1 year, at 6 per cent. per annum?

$500
6

100)$30|00 Ans.

2. What is the interest of 225 dollars for 1 year, at 7 dollars per cent. per annum? Ans. $15 75.

3. What is the interest of 384 dollars 50 cents, for 1 year, at 5 dollars per cent. per annum? Ans. $19 22½.

4. What is the *amount* of $275 for 1 year, at 6 per cent. per annum? Ans. $291 50.

$275
6

16,50 interest
275,00 principal

$291,50 amount

5. What is the interest of 1654 dollars 81 cents for 1 year, at 5 dollars per cent. per annum? Ans. $82 74+.

6. What is the interest of 1500 dollars, for 1 year, at ½ dollar per cent. per annum? Ans. $7 50.

7. What is the amount of $736, at 6 per cent. per annum, for 1 year. 780 dols. 16.

8. What is the interest of 524 dollars, for 1 year, at 5¼ dollars per cent. per annum? Ans. $27 51.

9. What would be the interest of 842 dollars, for 1 year, at 5½ dollars per cent. per annum? Ans. $46 31.

Case 2.

When the interest is required for several years.

Rule.—Find the interest for one year, and multiply the interest for one year by the number of years.

EXAMPLES.

1. What is the interest of 500 dollars, for 4 years, at 6 dollars per cent. per annum?

$500
6
---
30 00
4

$120 00 Ans.

2. What will be the interest of 540 dollars, for 2 years, at 5 dollars per cent. per annum? Ans. $54 00.

3. What would be the interest of 482 dollars, for 7 years, at 6 dollars per cent. per annum? Ans. $202 44.

4 What is the amount of $736 81¼ with 7 years, nine months interest due on it, at 6 per cent. per annum? Ans. $1079 43¾.

Note.—If the interest is required for years and months, multiply the interest for 1 year by the number of years, and take the aliquot parts of the interest for 1 year, for the months.

$736 81¼
6

6 mo.	½	4420,87½ interest 1 year
		7
3 mo.	¼	30946,12½ interest 7 years
		2210,43¾ interest 6 months
		1105,21¾+ 3
		34261,78 interest for 7 yr. 9 mo.
		73681,25 principal
		$107943 03 amount

5. What is the amount of $362 25 for 4 years 6 mo. at 6 per cent. per annum? Ans. $460 05¼.

Case 3.

When the interest is required for any number of months, weeks or days, less or more than one year.

Rule.—Find the interest of the given sum for one year Then, by proportion,

As 1 year
Is to the given time,
So is the interest of the given sum (for 1 year)
To the interest for the time required.

Or take the aliquot parts of the interest for one year, for the given time, as in note, Case 2.

EXAMPLES.

1. What is the interest of $560 for 2 years and 6 mo. at 5 per ct. per annum? Ans. $70.

560
5

6 mo.	½	2800 interest for 1 year
		2 years
		5600
		1400
		$70 00 interest for 2 years 6 months.

2. What is the interest of 325 dollars, for 4 years and 2 months, at 4 dollars per cent. per annum?

Ans. $54 16 cts. 6m.

3. What is the interest of 840 dollars for 5 years and 3 months, at 4 dollars per cent. per annum?

Ans. $176 40.

4. What is the interest of 840 dollars, for 5 years and 4 months, at 7 dollars per cent. per annum?

Ans. $313 60.

5. What is the interest of 560 dollars, for 4 months, at 6 dollars per cent. per annum?

560
6

100)33 60

m.	*m.*	*$ cts.*	*$ cts.*
As 12	: 4	:: 33 60	: 11 20 Ans.

6. What is the interest of 1200 dollars, for 15 weeks, at 5 dollars per cent. per annum? Ans. $17 30.

7. What will be the interest of 240 dollars, for 61 days, at 4½ dollars per cent. per annum? Ans. $1 90.+

8. What is the interest of $1000, for 14 months, at 7 per cent. per annum? Ans. $81 66⅔.

9. What is the interest of 450 dollars, for 6 months and 20 days, at 5½ dollars per cent. per annum?

Ans. $13 75.

10. What is the interest of 375 dollars 25 cents, for 3 years 2 months 3 weeks and 5 days, at 6 dollars per ct. per annum? Ans. $72 85.+

11. What is the amount of $736 for 28 weeks, at 10 per cent. per annum? Ans. $775 68.

Case 4.

To find the interest of any sum for any number of days, as computed at banks.

Rule.—Multiply the dollars by the number of days, and divide by 6; the quotient will be the answer in mills.

The interest of any number of dollars for 60 days, at 6 per cent. will be exactly the number of cents; and if any other rate per cent. is required, take aliquot parts, and add or subtract according as the rate per cent. is more or less than 6.

EXAMPLES.

1. What is the interest of 563 dollars, for 60 days, at 6 per cent. per annum—and likewise at 7 per ct. per an.?

$563
60

6)33780

5630 mills, in. at 6 per cent.

Ans. $5,63 at 6 per cent.
$6,56.8 at 7 per cent.

1 | 1/6 | $5630
938

Interest at 7 per cent. 6568 mills.

2. What is the interest of 854 dollars, for 30 days, at 6 per cent. per annum? Ans. $4 27.

3. What is the interest of 1100 dollars, for 48 days, at 6 per cent. per annum? Ans. $8 80.

4. What is the interest of 3459 dollars, for 75 days, at 6 per cent. per annum? Ans. $43 23 cts. 7 m.+

5. What is the interest of 1500 dollars, for 60 days, at 5 per cent. per annum? Ans. $12 50.

CASE 5.

The amount, time, and rate per cent. given, to find the principal.

RULE.—Find the amount of 100 dollars for the time required, at the given rate per cent.

Then, by proportion, as the amount of 100 dollars for the time required, (at the given rate per cent.) is to the amount given, so is 100 dollars to the principal required.

EXAMPLES.

1. What principal, at interest for 8 years, at 5 per ct. per annum, will amount to 840 dollars? Ans. $600.

5 dollars
8 years

40 Int. of $100 for 8 yr.
100

140 Amt. of $100 for 8 yr.

$ $ $ $
140 : 840 :: 100 : 600

2. What principal, at interest, for 6 years, at 4 per cent. per annum, will amount to $1240. Ans. $1000

3. What principal, at interest for 5 years, at 6 per ct. per annum, will amount to 2470 dollars? Ans. $1900.

Case 6.

The principal, amount, and time given, to find the rate per cent.

Rule.—Find the interest for the whole time given, by subtracting the principal from the amount.

Then, as the principal is to 100 dollars, so is the interest of the principal for the given time, to the interest of 100 dollars for the same time.

Divide the interest last found by the time, and the quotient will be the rate per cent. per annum,

Or by compound proportion.

EXAMPLES.

1. At what rate per cent. per annum, will 600 dollars amount to 744 dollars, in 4 years? Ans. 6 per cent.

$744 amount
600 principal
144 interest

$ $ $ $
As 600 : 100 : : 144 : 24.
yr. $
4) 24 (6 rate per cent.

Or by compound proportion:

$ $ $
As 600 : 100 : : 144 : 6 rate per cent.
yr. yr.
4 : 1

2. At what rate per cent. per annum, will $1200 amount to $1476, in 5 years and 9 months?

Ans. 4 per cent.

3. If 834 dollars, at interest 2 years and 6 months, amount to 927 dollars 82½ cents, what was the rate per cent. per annum? Ans. 4½ per cent.

Case 7.

To find the time, when the principal, amount, and rate per cent. are given.

Rule.—Divide the whole interest by the interest of the principal for one year, and the quotient will be the time required, or by proportion.

EXAMPLES.

1. In what time will 400 dollars amount to 520 dollars, at 5 per cent. per annum? Ans. 6 years.

$	$				
400	520				
5	400				
20|00	20)120(6	$ 20	$ 120	Y. 1	Y. 6 Ans.

2. In what time will £1600 amount to £2048, at 4 per cent. per annum? Ans. 7 years.

3. Suppose 1000 dollars, at 4½ per cent. per annum, amount to 1281 dollars 25 cents, how long was it at interest? Ans. 6Y. 3mo.

COMPOUND INTEREST.

Compound interest is that in which the interest for one year is added to the principal, and that amount is the principal for the second year; and so on for any number of years.

Rule.—Find the amount of the given sum for the first year by simple interest, which will be the principal for the second year; then find the amount of the principal for the second year for the principal for the third year; and so on for any number of years.

Subtract the first principal from the amount, and the remainder will be the compound interest required.

EXAMPLES.

1. What is the compound interest of 150 dollars for 5 years, at 4 per cent. per annum?

Ans. $32,49.

$150	$150	
4	6	inst 1st year
6|00 int. 1 yr.	156	amount 1st year
	6,24	int. 2d year
$156	162,24	amount 2d year
4	6,48.9	int. 3d year
6|24	168,72.9	amount 3d year
	6,74.9	int. 4th year.
162,24	175,47.8	amount 4th year
4	7,01.9	int. 5th year
6|48.96	182,49.7	amount 5th year
	150,00.0	principal
	32,49.7	compound int. for 5 years.

2. What is the compound interest of 760 dollars, for 3 years, at 6 dollars per cent. per annum?

Ans. $145 17 cts. 2 m.+

3. What is the compound interest of £242 10s. 6d., for 4 years, at £6 per cent. per annum?

Ans. £63 13s. 1 p.+

4. What is the amount of 1300 dollars, for 3 years, at 5 dollars per cent. per annum, compound interest?

Ans. $1504 91 cts. 2 m.+

5. How much is the amount of 3127 dollars, for 4 years, at 4½ dollars per cent. per annum, compound interest? Ans. $3729 00cts. 5m.

Questions.

What is interest?
What is the principal?
What is the rate per cent.
What is the amount?
How do you proceed when the interest for several years is required?

What is to be noted if the interest is required for years and months?

When the interest is required for any number of weeks or days, less or more than one year, how do you perform the operation?

How do you proceed to find the interest, at 6 per cent. for any number of days, as computed at banks?

What is to be observed when the interest is at any other rate than 6 per cent.?

How do you proceed, when the principal, amount, and time are given, to find the rate per cent.?

How do you find the time, when the principal, amount, and rate per cent. are given?

What is compound interest?

How is compound interest computed?

PROMISCUOUS EXERCISES.

1. What is the interest of 620 dollars 25 cents for 5 years, at 5½ per cent. per annum?

Ans. $190 38 cts. 8 m.

2 What is the interest of $420, for 1 year, at 7 per cent. per annum? Ans. $29 40.

3 What is the interest of 1450 dollars, for 60 days, at 6 per cent. per annum? Ans. $14 50 cts.

4 What is the compound interest of $626 25, for 3 years, at 5½ per cent. per annum?

Ans. $103 91.+

5 What is the interest of $1659 for 3 weeks, at 4 per cent. per annum? Ans. $3 82½.+

6 In what time will 500 dollars amount to 1000 dollars at 8 per cent. per annum, simple interest?

Ans. 12 years, 6 months.

7 What principal, at interest for 6 years and 6 months, at 2 per cent. per annum, will amount to 250 dollars?

Ans. $221 23 cts. 9 m.

8 At what rate per cent. per annum, will $300 amount to $450, in 5 years? Ans. 10 per cent.

INSURANCE, COMMISSION, AND BROKAGE.

INSURANCE, Commission and Brokage, are allowances made to insurers, factors, and brokers, at such rate per cent. as may be agreed on between the parties.

RULE.

Proceed in the same manner as though you were required to find the interest of the given sum for one year.

EXAMPLES.

1 What is the commission on 625 dollars, at 4 dollars per cent?

$625
4

Ans. $25,00

2 What is the commission on $1320, at 5 per cent.? Ans. $66.

3 What is the commission on 3450 dollars, at 4½ dollars per cent.? Ans. $155,25.

4 The sales of certain goods amount to 1680 dollars: what sum is to be received for them, allowing 2½ dollars per cent. for commission? Ans. $1633,80.

5 What is the insurance of $760, at 6½ per cent.? Ans. $49,40.

6 What is the insurance of 5630 dollars, at 7¾ dollars per cent.? Ans. $436 32 cts. 5 m.

7 A merchant sent a ship and cargo to sea, valued at 17654 dollars: what would be the amount of insurance, at 18¾ dollars per cent.? Ans. $3310 12½ cts.

8 What is the brokage on 2150 dollars at 2 per cent.? Ans. $43.

9 When a broker sells goods to the amount of 984 dollars 50 cents, what is his commission, at 1¼ dollars per cent.? Ans. $12 30½ cts.+

10 If a broker buys goods for me, amounting to 1650

dollars 75 cents, what sum must I pay him, allowing him 1½ per cent.? Ans. $24 76 cts. 1 m.+

Questions.

What are Insurance, Commission, and Brokage?

How do you proceed to find the Insurance, Commission, or Brokage?

In what does this rule differ from interest? It takes no account of *time*.

DISCOUNT.

Discount is an abatement of so much money from any sum to be received before it is due, as the remainder would gain, put to interest for the given time and rate per cent.

Rule.

Find the interest of 100 dollars for the given time, at the given rate per cent.

Add the interest so found to 100 dollars, then by proportion,

As the amount of 100 dollars for the given time,
Is to the given sum,
So is 100 dollars,
To the present worth.

If the discount be required, subtract the present worth from the given sum, and the remainder will be the discount.

Note.—When discount is made without regard to time, it is found precisely like the interest for one year.

Examples.

1 What is the present worth of 420 dollars, due in 2 years, discount at 6 per cent. per annum?

Ans. $375.

$	$	$	$	
6	112 :	420 ::	100 :	375
2				
12				
100				
112				

2 What is the present worth of 850 dollars, due in 3 months, at 6 per cent. per annum?

Ans. $837 43¾ cts.+

3 What is the discount of 645 dollars, for 9 months, at 6 per cent. per annum? Ans. $27 77¼ cts.

4 What is the present worth of 775 dollars 50 cents, due in 4 years, at 5 per cent. per annum?

Ans. $646,25.

5 What is the present worth of 580 dollars, due in 8 months, at 6 per cent. per annum? Ans. $557,69.+

6 What is the present worth of 954 dollars, due in 3 years, at 4½ per cent. per annum?

Ans. $840 52 cts. 8 m.+

7 What is the discount of 205 dollars, due in 15 months, at 7 per cent per annum?

Ans. $16 49 cts. 5 m.+

8 Bought goods amounting to 775 dollars, at 9 months' credit: how much ready money must be paid, allowing a discount of 5 per cent. per annum?

Ans. $746 98 cts. 7 m.

9 I owe A. to the value of 1005 dollars, to pay as follows: viz. 475 dollars in 10 months, and the remainder in 15 months; what is the present worth, allowing discount at 6 per cent. per annum?

Ans. $945 40 cts. 4 m.

10 What is the difference between the interest of 2260 dollars, at 6 per cent. per annum, for 5 years, and the discount of the same sum for the same time and rate per cent.? Ans. $156 46 cts. 2m.+

11 What is the discount of 520 dollars, at 5 per cent.?

$520
5

$26,00 Ans.

12 How much is the discount of $782, at 4 per cent.? Ans. $31, 28

13 What is the discount of 476 dollars, at 3 per cent.? Ans. $14,28.

14 Bought goods on credit, amounting to 1385 dollars: how much ready money must be paid for them, if a discount of 6 per cent. be allowed? Ans. $1301,90.

15 I hold A.'s note for 650 dollars; but I agree to allow him a discount of 4½ per cent. for present payment: what sum must I receive? Ans. $620,75.

Questions.

What is discount?

What is first to be done?

After having found the interest of 100 dollars, at the given time and rate per cent., what is next to be done?

After having added the interest so found to 100 dollars or pounds, by what rule do you work to find the discount?

When discount is made without regard to time, how is it found?

EQUATION OF PAYMENTS.

EQUATION is a method of reducing several stated times, at which money is payable, to one mean, or equated time, when the whole sum shall be paid.

RULE.

Multiply each payment by its time, and divide the sum of all the products by the whole debt, the quotient will be the equated time.

Proof.—The interest of the sum payable at the equa ted time, at any given rate, will equal the interest of th several payments for their respective times.

EXAMPLES.

1 C. owes D. 100 dollars, of which the sum of 5 dollars is to be paid at 2 months, and 50 at 4 months but they agree to reduce them to one payment; whe must the whole be paid? Ans. 3 months

$$50\times 2=100$$
$$50\times 4=200$$

$$100)300(3 \text{ months}$$

2 A merchant hath owing to him 300 dollars, to b paid as follows: 50 dollars at 2 months, 100 dollars at months, and the rest at 8 months; and it is agreed t make one payment of the whole; when must that tim be? Ans. 6 months

3 F. owes H. 2400 dollars of which 480 dollars ar to be paid present, 960 dollars at 5 months, and the re at 10 months; but they agree to make one payment o the whole, and wish to know the time? Ans. 6 months

4 K. is indebted to L. 460 dollars which is to be di charged at 4 several payments, that is ¼ at 2 months, at 4 months, ¼ at 6 months, and ¼ at 8 months; but the agreeing to make one payment of the whole, the equa ted time is therefore demanded? Ans. 5 months

5 P. owes Q. 420 dollars, which will be due 6 month hence, but P. is willing to pay him 60 dollars now, pro vided he can have the rest forborn a longer time: it i agreed on; the time of forbearance therefore is required Ans. 7 months

6 A merchant bought goods to the amount of 200 dollars and agreed to pay 400 dollars at the time of pur chase, 800 dollars at 5 months, and the rest at 10 months but it is agreed to make one payment of the whole; wha is the mean or equated time? Ans. 6 months

BARTER.

BARTER is the exchanging of one kind of goods for another, duly proportioning their values, &c.

RULE.

The questions that come under this head, may be done by the compound rules, the Rule of Three, or Practice, as may be most convenient.

EXAMPLES.

1 A country storekeeper bought 150 bushels of salt, at 56 cents per bushel; and is to pay for it in corn, at 33⅓ cents per bushel; how much corn will pay for the salt?

ct.	*ct.*	*bu.*	*bu.*
As 33⅓	: 56	: : 150	: 252

OR

ct.		
56	33⅓	)8400
150	3	3
2800	100	)252|00
56		

252 bushels of corn.

Cost of the salt. 8400 cts.

2 How much wheat, at 1 dollar 25 cents per bushel, will pay for 35 sheep, at 2 dollars 25 cents a piece?

Ans. 63 bush.

3 How much sugar, at 9 cents per lb. will pay for 1 dozen pair of shoes, at 1 dollar 75 cents per pair?

Ans. 233⅓ lbs.

4 How much tea, at 80 cents per lb. will pay for 560 lbs. of pork, at 5 cents per lb.? Ans. 35 lbs.

5 Bought 4 hats for 3 dollars 50 cents; 4 dollars; 4 dollars 50 cents; and 5 dollars—how much corn at 32 cents will pay for them? Ans. 53 bush. 4 qts.

6 A. has 420 bushels of corn, which he barters with B. for oats, and is to receive 4 bushels of oats for 3 of corn—how many bushels of oats must A. receive?

Ans. 560 bush.

7 A boy bartered 735 pears for marbles, giving pears for 2 marbles—how many marbles ought he have received? Ans. 294 marble

8 A boy exchanges marbles for pears, and gives marbles for 5 pears—how many pears should he receiv for 294 marbles? Ans. 735 pear

9 A farmer bartered 3 barrels of flour, at 5 dollars 2 cents per barrel, for sugar and coffee, to receive an equ quantity of each—how much of each must he receiv admitting the sugar to be valued at 9 cents per lb. ar the coffee at 14 cents? Ans. 68⅛ lb. nearl

10 A bartered 42 hats, at 1 dollar 25 cents per ha with B. for 50 pair of shoes, at 1 dollar 12½ cents p pair—who must receive money, and how much?

Ans. B. $3,7

11 Sold 75 barrels of herrings, at 2 dollars 75 cen per barrel, for which I am to receive 75 bushels of whea at 1 dollar 8 cents per bushel, and the residue in money- how much money must I receive?

Ans. 125 dolls. 25 c

12 Sold 35 yards of domestic, at 20 cents per yar and am to receive the amount in apples, at 25 cents p bushel—how many bushels must I have?

Ans. 28 bus

13 Gave 35 yards of domestic for 28 bushels of a ples, at 25 cents per bushel—what was the domest rated at per yard? Ans. 20 c

14 What is rice per lb. when 340 lb. are given for yards of cloth, at 4 dollars 25 cents per yard?

Ans. 5 c

15 Gave in barter 65 lbs. of tea for 156 gallons rum, at 33¼ per gallon—what was the tea rated at?

Ans. 80 cts. per l

16 Q. has coffee worth 16 cents per pound, but barter raised it to 18 cts.; B. has broad cloth worth dollars 64 cents per yard—what must B. raise his clo to, so as to make a fair barter with Q? Ans. $5,2

17 B. had 45 hats, at 4 dollars per hat, for which A. gives him 81 dollars 25 cents in cash, and the rest in pork, at 5 cents per lb; how much pork will be required?
Ans. 1975 lb.

18 Two merchants barter; A. receives 20 cwt. of cheese, at 2 dollars 87 cents per cwt.; B. 8 pieces of linen, at 9 dollars 78 cents per piece; which of them must receive money, and how much? Ans. A. $20,84.

19 If 24 yards of cloth be given for 5 cwt. 1 qr. of tobacco, at 5 dollars 7 cents per hundred; what is the cloth rated at per yard? Ans. $1.109.

20 A. barters 40 yards of cloth, at 98 cents per yard, with B. for 28½ lbs. of tea, at 1 dollar 53 cents per lb.; which must pay balance, and how much?
Ans. A. $4,405.

21 A has 7½ cwt. of sugar, at 8 cents per lb., for which B. gave him 12½ cwt. of cheese; what was the cheese rated at per lb.? Ans. $. 048.

22 What quantity of sugar, at 8 cts. per lb. must be given in barter for 20 cwt. of tobacco, at 8 dollars per cwt.? Ans. 17 cwt. 3 qrs. 12 lb.

23 P. has coffee, which he barters with Q. at 11 cts. per lb. more than it cost him, against tea, which stands Q. in 1 dollar 33 cents the lb., but he puts it at 1 dollar 36 cents; query, the prime cost of the coffee?
Ans. $. 443+

LOSS AND GAIN.

By Loss and Gain, merchants and dealers compute their gains or losses.

Rule.

Work by the Compound Rules, by Proportion, or in Practice, as may be most convenient.

EXAMPLES.

1 Bought 1234 lbs. of coffee, at 12½ cts. per lb., and sold the whole for 160 dollars; did I lose or gain by it, and how much? Ans. gained $5,75.

2 Bought 120 dozen knives, at 2 dollars 50 cents per dozen, and sold them at 18¾ cents a piece; did I gain or lose, and how much? Ans. lost $30.

3 Bought 1234 yards of muslin, for 17½ cents, and sold it at 20 cents per yard; what was the gain? Ans. $30,85.

4 Bought 10 chests of tea, each 63 lbs. neat, for 600 dollars, and retailed it at 87½ cents per lb.; did I gain or lose, and how much? Ans. lost 48 dol. 75 ct.

5 Gave 285 dollars 25 cents for 4564 lbs. of bacon, and sold it for 365 dollars 12 cents; what was the gain per lb? Ans. $. 1¼ cts.

6 Bought 1234 yards of muslin, for 246 dollars 80 cents, and sold it for 215 dollars 95 cents; what did I lose per yard? Ans. $. 2½ cts.

7 Gave 25 cts. per bushel for corn, and sold it at 28 cents; what is the gain per cent.? Ans. 12 dolls. per 100 dolls.

8 Sold corn at 25 cts. per bushel, and 4 cts. loss; what was the loss per cent.? Ans. 16 dolls.

9 Bought 12 cwt. 25 lbs. of sugar, for 106 dollars, and sold it at 9½ cts. per lb.; what did I gain per cent.? Ans. 18 dolls. 75 cts.

10 Bought 126 gallons of wine for 150 dollars, and retailed it at 20 cts. per pint; what was the gain per cent.? Ans. 34 dolls. 40 cts.

11 Sold a quantity of goods, for 748 dollars 66 cents, and gained 10 per cent; what did I give for them.? Ans. 680 dols. 60 cts.

	dols.	*dols.*	*dols.*
100	110 : 100 : :		748,66
10			100
110			110)74866,00($680,60

12 Sold goods to the amount of $1234, and gained at the rate of 20 per cent.; what was the prime cost?
Ans. $1028,33⅓

13 Sold a quantity of goods, for $475, and at a loss of 12 per cent.; what did I give for them?

	dols.	*dols.*	*dols.*
100	88 : 100 : :		475
12			100
88			88)47500(539,77+Ans.

14 Sold hats to the amount of $136, at 20 per cent. loss; what was the first cost? Ans. $170.

15 Laid out $755 in salt; how much must I sell it for, so as to gain 12 per cent.?

12
100

As 100 : : 112 : 755 : : 845,60 Ans.

16 Bought 32 yards of mole skin for 128 dollars; what must I sell it for per yard, so as to gain 20 per cent.? Ans. 4 dols. 80 cts.+

17 Bought 17 yards of silk for 21 dollars; how much per yard must I retail it for, and gain 25 per cent.?
Ans. 1 dol. 54 cts.+

18 Bought 64 yards of muslin for 12 dollars 50 cents, but proving a bad bargain, I am willing to lose 8 per cent; what must I sell it at per yard? Ans. 19 cts. 4 m.+

19 When hats are bought at 48 cents, and sold at 54 cents; what is the gain per cent.? Ans. 12½

20 If, when cloth is sold for 84 cents per yard, the is gained 10 per cent.; what will be the gain per ce when it is sold for 1 dollar 2 cents per yard?

Ans. 33 dols. 57 cts.

21 Bought a chest of tea, weighing 490 lbs. for $1 50 ct. and sold it for $137 20 cents; what was the pro on each lb.? Ans. 3 c

22 Bought 12 pieces of white cloth, for 16 dollars cents per piece; paid 2 dollars 87 cents a piece dying; for how much must I sell them each, to gain per cent.? Ans. 23 dols. 24

23 If 28 pieces of stuff be purchased at 9 dollars cents per piece, and 10 of them sold at 14 dollars cents, and 8 at 12 dollars per piece; at what rate mu the rest be disposed of, to gain 10 per cent. by the whol

Ans. 5 dols. 56

24 Sold a yard of cloth for 1 dollar 55 cents, which was gained at the rate of 15 per cent.; but if had been sold for 1 dollar 72 cents; what would have be the gain per cent.? Ans. 27 dols. 68

25 If, when cloth is sold at $. 935 a yard, the ga is 10 dollars per cent.; what is the gain or loss per cen when it is sold at 80 cents per yard?

Ans. 5 dollars 88+lo

26 A draper bought 100 yards of broad cloth, f which he gave $56—I desire to know how he must s it per yard, to gain $19 in the whole?

Ans. 75 ct. per ya

27 A draper bought 100 yards of broad cloth for $5 I demand how he must sell it per yard, to gain $15 laying out $100? Ans. 64 ct. 4

28 Bought knives at 11 cents, and sold them at cents; what will I gain by laying out 100 dollars knives? Ans. 9 dols. 09

29 Bought knives at 11 cents, and sold them at cents; what did I gain by selling to the amount of 1 dollars? Ans. 8 dols. 333

30 If by selling 1 lb. of pepper for 10¼ cents, there are 2 cents lost; how much is the loss per cent.?
Ans. 16 dols.

31 A merchant receives from Lisbon, 180 casks of raisins, which stands him in here 2 dollars 13 cents each, and by selling them at 3 dollars 68 cents per cwt., he gains 25 per cent.; required the weight of each cask, one with another? Ans. 81 lb. nearly.

FELLOWSHIP.

FELLOWSHIP is a method by which merchants and others adjust the division of property, loss, or gain, &c., in proportion to their several claims.

CASE 1. SIMPLE FELLOWSHIP.

When the claims are in proportion to the amount of stock, labor, &c., without regard to time.

RULE. (*By Proportion.*)

As the whole amount of stock or labor,
Is to each man's portion,
So is the whole property, loss, or gain,
To each man's share of it.

Proof.—The sum of all the shares must equal the whole gain, &c.

EXAMPLES.

1 Two men bought a stock of goods for 450 dollars, of which A. paid 320, and B. 160. They gained 128 dollars by the transaction; what was the share of each?
Ans. A. received 85 dols. 33¼ cts. and B. 42 dollars 66¾ cts.

		$	$	$	$ *ct.*	Proof
A's. stock	$320	As 480 :	320 ::	128 :	85,33¼	$85,33¼
B's. stock	160					42,66¾
Whole st'k	480	As 480 :	320 ::	128 :	42,66¾	128,00

2 Three workmen having undertaken to do a piece of work for 275 dollars, agreed to divide their profits in proportion to the amount of labor each one performed. M. labored 50 days, N. 65 days, and O. 85 days: what was the share of each?

Ans. M. received 68 dols. 75 cts.; N. 89 dols. 37½ cts.; and O. 116 dols. 87½ cts.

3 A merchant being deceased, worth 1800 dollars, is found to owe the following sums: to A. 1200 dollars, to B. 500 dollars, to C. 700 dollars: how much is each to have in proportion to the debt?

Ans. A. 900 dols., B. 375 dols, and C. 525 dols.

4 Three drovers pay among them 60 dollars for pasture, into which they put 200 cattle, of which A. had 50, B. 80, and C. 70: I would know how much each had to pay? Ans. A. 15 dols., B. 24 dols., C. 21 dols.

5 A man failing, owes the following sums: to A. 120 dollars, to B. 250 dollars 75 cents, to C. 300 dollars, to D. 208 dollars 25 cents; and his whole effects were found to amount to but 650 dollars: what will each one receive in proportion to his demand?

Ans. A. $ 88.73.+ C. $221.84.+
B. $185.42.+ D. $153.99.+

6 A bankrupt is indebted to A. 500 dollars 37½ cents——to B. 228 dollars—to C. 1291 dollars 23 cents—to D. 709 dollars 40 cents; and his estate is worth 2046 dollars 75 cents: how much does he pay per cent., and what does each creditor receive?

Ans. He pays 75 per cent., and A. receives 375 dollars 27½ cts.; B. 171 dols.; C. 968 dols. 42½ cts.; and D. 532 dols. 5 cts.

7 If a man is indebted to A. 250 dollars 50 cents, to B. 500 dollars, to C. 349 dollars 50 cents, but when he comes to make a settlement, it is found he is worth but 960 dollars, how much will each one receive, if it be in proportion to their respective claims?

Ans. A. $218 61 cts. 8 m.+
B. $436 36 cts. 3 m.+
C. $305 01 ct. 8 m.+

Case 2. Compound Fellowship.

When the respective stocks are considered with relation to *time*.

Rule. (*By Proportion.*)

Multiply each man's stock by its time; add the several products together; then:
As the sum of the products
Is to each particular product,
So is the whole gain or loss
To each man's share of the gain or loss.

EXAMPLES.

1 Three merchants traded together; A put in 120 dollars for 9 months, B. 100 dollars for 16 months, and C. 100 dollars for 14 months, and they gained 100 dollars; what is each man's share?

	$		mo.	
A's. stock	120	×	9	= 1080
B's. stock	100	×	16	= 1600
C's. stock	100	×	14	= 1400
			Sum	4080

Sum.	*Prod.*	$	$	
As 4080	: 1080 :: 100	:	26,47+	A's. share.
As 4080	: 1600 :: 100	:	39,21+	B's. share.
As 4080	: 1400 :: 100	:	34,31+	C's. share.

2 Three men traded together; L. put in 88 dollars for 3 months, M. 120 dollars for 4 months, and N. 300 dollars for 6 months; they gained 184 dollars: what will each man receive of the gain?

Ans. { L. $ 19 09 cts. 4 m.
M. $ 34 71 cts. 6 m.
N. $130 18 cts. 8 m.

3 Two merchants entered into partnership for 16 months: A. put in at first $600, and at the end of 9 months put in $100 more; B. put in at first $750, and at the end of 6 months took out $250, at the close of the time their gain was $386, what was the share of each?

Ans. A's. share was $200,79¼; B's. share was $185,20.

4 A., B., and C., made a stock for 12 months; A. put in at first $873,60, and 4 months after he put in $96,00 more; B. put in at first $979,20, and at the end of 7 months he took out $206,40; C. put in at first $355,20, and 3 months after he put in $206,40, and 5 months after that he put in $240,00 more. At the end of 12 months, their gain is found to be $3446,40; what is each man's share of the gain?

Ans. A's. share is $1334,82¼
B's. - - $1271,61¼+
C's. - - $839,96

Questions.

What is Fellowship?

By what rule are its operations performed?

When is Fellowship simple?

When is it compound?

In what respect is Fellowship compound?

Ans. The proportion is compound: that is, the division of property, gain, &c., is founded on the compound proportion of the stock and time.

VULGAR FRACTIONS.

A VULGAR FRACTION is a part, or parts of a unit expressed by two numbers placed one above the other with a line between them. As $\frac{1}{2}$, $\frac{2}{3}$, &c.

The number below the line is the *denominator*, the number above the line is the *numerator*.

The *denominator* denotes the number of parts into which the *unit* is divided.

The *numerator* shows how many of those parts are to be taken.

Fractions are either *proper*, *improper*, or *compound*.

A *proper* fraction is one whose numerator is *less* than its denominator, as $\frac{5}{8}$ or $\frac{3}{7}$.

An *improper* fraction is one whose numerator is *greater* than its denominator, as $\frac{9}{5}$ or $\frac{9}{4}$.

A *compound* fraction is a fraction of a fraction, as $\frac{1}{2}$ of $\frac{2}{3}$, or $\frac{2}{3}$ of $\frac{3}{4}$.

A *mixed* number is a whole number and a fraction.

REDUCTION OF VULGAR FRACTIONS.

CASE 1.

To reduce a fraction to its lowest terms.

RULE.

Divide the terms by any number that will divide both without a remainder, and divide the quotient in the same manner, and so on till no number greater than one will divide them: the fraction is then at its lowest terms.

EXAMPLES.

1. Reduce $\frac{84}{168}$ to its lowest terms.

$$4)\frac{84}{168}=\frac{21}{42}=\frac{7}{8}$$ result.

2. Reduce $\frac{9}{36}$ to its lowest terms. Res. $\frac{1}{4}$
3. Reduce $\frac{110}{130}$ to its lowest terms. Res. $\frac{11}{13}$
4. Reduce $\frac{48}{56}$ to its lowest terms. Res. $\frac{6}{7}$

NOTE.—When a divisor cannot readily be found, divide the denominator by the numerator, and that divisor by the remainder, and so on, till nothing remain: the last divisor is the common measure of the two numbers; with which proceed as before.

5. Reduce $\frac{85}{136}$ to its lowest terms. Res. $\frac{5}{8}$

5 Reduce $\frac{85}{136}$ to its lowest terms. Res. $\frac{5}{8}$.

85

85)136(1
85

51)85(1
51

34)51(1
34

17)34(2
34

Here 17 being the last divisor, is the common measure of 85 and 136.

$$17 \left| \frac{85}{136} \right\} = \left\{ \frac{5}{8} \right.$$

6. Reduce $\frac{91}{117}$ to its lowest terms. Res. $\frac{7}{9}$.
7. Reduce $\frac{144}{216}$ to its lowest terms. Res. $\frac{2}{3}$.
8. Reduce $\frac{3619}{6251}$ to its lowest terms. Res. $\frac{11}{19}$.

Case 2.

To reduce a mixed number to an improper fraction.

RULE.

Multiply the whole number by the denominator, and add the numerator to the product for the numerator of the improper fraction, and place the denominator under it.

EXAMPLES.

1. Reduce $12\frac{4}{9}$ to an improper fraction. Res. $\frac{112}{9}$.

12 $\frac{4}{9}$
9

112
9

Nine 12's are 108; add 4 makes 112 ninths.

2. Reduce $17\frac{3}{7}$ to an improper fraction. Res. $\frac{122}{7}$.
3. Reduce $45\frac{2}{3}$ to an improper fraction. Res. $\frac{137}{3}$.
4. Reduce $24\frac{13}{17}$ to an improper fraction. Res. $\frac{421}{17}$.

Case 3.

To reduce an improper fraction to its proper value.

RULE.

Divide the numerator by the denominator, and the quotient will be the whole number; the remainder, if any, will be the numerator of the fraction.

EXAMPLES.

1 Reduce $\frac{17}{5}$ to its proper value. Res. $3\frac{2}{5}$.

$$5)17$$
$$3\frac{2}{5}$$

2 Reduce $\frac{112}{9}$ to its proper terms. Res. $12\frac{4}{9}$.
3 Reduce $\frac{122}{7}$ to its proper terms. Res. $17\frac{3}{7}$.
4 Reduce $\frac{421}{17}$ to its proper terms. Res. $24\frac{13}{17}$.

Case 4.

To reduce several fractions to other fractions having a common denominator, and retaining their value.

RULE.

Multiply each numerator into all the denominators but its own, for the respective numerators; and all the denominators together, for a common denominator.

EXAMPLES.

1 Reduce $\frac{2}{3}$ $\frac{3}{4}$ and $\frac{5}{6}$ to a common denominator.
Res. $\frac{48}{72}$ $\frac{54}{72}$, and $\frac{60}{72}$.

$2\times4\times6=48$
$3\times[illegible]\times6=54$ } Numerators
$5\times[illegible]\times4=60$
$3\times4\times6=72$, common denominator.

Then we have $\frac{48}{72}$ for $\frac{2}{3}$; $\frac{54}{72}$ for $\frac{3}{4}$, and $\frac{60}{72}$ for $\frac{5}{6}$.

Reduce each new fraction to its lowest terms, and the result will prove the work to be right.

2. Reduce $\frac{3}{4}$, $\frac{5}{6}$, and $\frac{7}{12}$, to a common denominator
Res. $\frac{216}{288}$, $\frac{240}{288}$, and $\frac{168}{288}$.
3. Reduce $\frac{1}{2}$, $\frac{2}{3}$, $\frac{5}{6}$, and $\frac{7}{12}$, to a common denominator.
Res. $\frac{216}{432}$, $\frac{288}{432}$, $\frac{360}{432}$, and $\frac{252}{432}$.
4. Reduce $\frac{7}{8}$, $\frac{2}{9}$, $\frac{3}{5}$, and $\frac{5}{6}$, to a common denominator.
Res. $\frac{630}{720}$, $\frac{160}{720}$, $\frac{432}{720}$, and $\frac{600}{720}$.

NOTE.—It is often convenient to use the *least possible* common denominator; to find which, divide the denominators by any number that will divide two or more of them without a remainder, setting down those that would have remainders; then multiply all the divisors and all the quotients together.

4	2	3	4	5	6	7	8	9
3	2	3	1	5	6	7	2	9
2	2	1		5	2	7	2	3
	1			5	1	7	1	3

$4\times3\times2\times5\times7\times3=2520$ common denom. Which may be divided separately by 2, 3, 4, 5, 6, 7, 8, and 9, without a remainder.

EXAMPLES.

5 Find the *least* common denominator for $\frac{3}{4}$, $\frac{7}{8}$, $\frac{11}{12}$, $\frac{5}{16}$, and $\frac{9}{20}$, and compute their equivalent fractions.

Res. $\frac{180}{240}$, $\frac{210}{240}$, $\frac{220}{240}$, $\frac{75}{240}$, $\frac{108}{240}$.

240 com. denom.

$\frac{3}{4}$	$60\times 3=180$
$\frac{7}{8}$	$30\times 7=210$
$\frac{11}{12}$	$20\times11=220$
$\frac{5}{16}$	$15\times 5=75$
$\frac{9}{20}$	$12\times 9=108$

6 Reduce $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$, $\frac{9}{10}$, and $\frac{11}{12}$, to their least common denominator. Res. $\frac{90}{120}$, $\frac{100}{120}$, $\frac{105}{120}$, $\frac{108}{120}$, and $\frac{110}{120}$.

7 Reduce $\frac{5}{8}$, $\frac{7}{10}$, $\frac{9}{16}$, $\frac{11}{24}$, to their least common denominator. Res. $\frac{150}{240}$, $\frac{168}{240}$, $\frac{135}{240}$, and $\frac{110}{240}$.

8 Reduce the above fractions to a common denominator, by the general rule, Case 4.

Res. $\frac{19200}{30720}$, $\frac{21504}{30720}$, $\frac{17280}{30720}$, $\frac{14080}{30720}$.

$5\times10\times16\times24=19200$
$7\times 8\times16\times24=21504$
$9\times 8\times10\times24=17280$
$11\times 8\times10\times16=14080$

Case 5.

To reduce a compound fraction to a simple one.

RULE.

Multiply the numerators together for a new numerator; and the denominators together for a new denominator.

EXAMPLES.

1 Reduce $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{9}{10}$ to a single fraction. Res. $\frac{9}{16}$.

$$\frac{3\times5\times9}{4\times6\times10} = \frac{135}{240} = \frac{9}{16}$$

2 Reduce $\frac{5}{9}$ of $\frac{4}{7}$ of $\frac{11}{12}$ to a single fraction. Res. $\frac{55}{189}$.

3 Reduce $\frac{2}{7}$ of $\frac{5}{9}$ of $\frac{4}{5}$ to a single fraction. Res. $\frac{8}{63}$.

4 Reduce $\frac{12}{14}$ of $\frac{5}{6}$ of $\frac{1}{2}$ to a single fraction. Res. $\frac{5}{14}$.

Case 6.

To reduce a fraction of one denomination to the fraction of another denomination, but greater, retaining the same value.

RULE.

Multiply the denominator of the fraction by the number of that denomination which it takes to make one of the next, and so on to the denomination required, and place the numerator of the given fraction over it.

EXAMPLES.

1 Reduce $\frac{2}{3}$ of a quart to the fraction of a bushel.*

$$\frac{qt.\ 2}{3\times8\times4=96} = \frac{2}{96} = \frac{1}{48}$$ Result, $\frac{1}{48}$ of a bushel.

2 Reduce $\frac{3}{4}$ of an ounce, Troy, to the fraction of a pound. Res. $\frac{3}{48}$, or $\frac{1}{16}$ of a pound.

3 Reduce $\frac{4}{5}$ of a nail to the fraction of a yard. Res. $\frac{4}{80}$, or $\frac{1}{20}$ of a yard.

3 Reduce $\frac{7}{8}$ of a perch to the fraction of an acre. Res. $\frac{7}{1280}$.

* That is, what part of a bushel are two-thirds of a quart?

4 Reduce $\frac{9}{13}$ of a pint to the fraction of a hogshead
Res. $\frac{1}{728}$ of a hhd.

Case 7.

To reduce the fraction of one denomination to the fraction of another, but less, *retaining the same value.*

RULE.

Multiply the given *numerator* by the parts of that between it and that to which it is to be reduced, and place the product over the given denominator for the fraction required.

EXAMPLES.

1 Reduce $\frac{1}{48}$ of a bushel to the fraction of a quart.
Res. $\frac{2}{3}$ of a quart.

2 Reduce $\frac{1}{20}$ of a yard to the fraction of a nail.
Res. $\frac{4}{5}$ of a nail.

3 Reduce $\frac{7}{1280}$ of an acre to the fraction of a perch.
Res. $\frac{7}{8}$ of a perch.

4 Reduce $\frac{1}{728}$ of a hogshead to the fraction of a pint.
Res. $\frac{9}{13}$ of a pint.

5 Reduce $\frac{1}{1584}$ of a day to the fraction of a minute.
Res. $\frac{10}{11}$ of a minute.

Case 8.

To reduce a fraction to its proper value or quantity, in whole numbers.

RULE.

Multiply the numerator by the parts of the integer, and divide by the denominator.

EXAMPLES.

1 Reduce $\frac{7}{8}$ of a yard to its proper quantity.
Res. 3 qr. 2 na.

7 eighths of a yd.	4 eighths of a qr.
4	4
8)28	8)16
$3\frac{4}{8}$ quarters	2 nails

2 Reduce $\frac{5}{9}$ of a pound, avoirdupois, to its proper quantity. Res. 8 oz. $14\frac{2}{9}$ dr.

3 Reduce $\frac{3}{4}$ of a pound, Troy, to its proper quantity. Res. 9 oz.

4 Reduce $\frac{4}{7}$ of a mile to its proper quantity. Res. 4 fur. 125 yd. 2 ft. $1\frac{5}{7}$ inch.

5 Reduce $\frac{7}{16}$ of an acre to its proper quantity. Res. 1 rood, 30 perch.

6 Reduce $\frac{3}{5}$ of a dollar to its proper quantity. Res. 60 cents.

7 Reduce $\frac{1}{3}$ of a pound to its proper value. Res. 6s. 8d.

8 Reduce $\frac{45}{73}$ of a year (365 days) to its proper quantity. Res. 225 days.

9 Reduce $\frac{7}{9}$ of a tun to its proper quantity. Res. 3 hhd. 7 gal.

10 Reduce $\frac{7}{8}$ of a ton to its proper quantity. Res. 15 cwt. 2 qr. 6 lb. 3 oz. $8\frac{8}{9}$ dr.

Case 9.

To reduce a given quantity to a fraction of any greater denomination of the same kind.

Rule.

Reduce the given quantity to the lowest denomination mentioned for a numerator; and the integer to the same denomination, for a denominator.

Examples.

1 Reduce 3 qr. 2 na. to the fraction of a yard. Res. $\frac{7}{8}$ of a yard.

	qr.	na.
	3	2
	4	
yd.	14	
$1 \times 4 \times 4 = 16$		$= \frac{7}{8}$

2 Reduce 2 roods 20 perches to the fraction of an acre. Res. $\frac{5}{8}$ of an acre.

3 Reduce 6 furlongs 16 poles to the fraction of a mile.
Res. $\frac{4}{5}$ of a mile.

4 Reduce 9 ounces, Troy, to the fraction of a pound.
Res. $\frac{3}{4}$ of a pound.

5 Reduce 7 hours 12 minutes to the fraction of a day.
Res. $\frac{3}{10}$ of a day.

Questions.

What is a *vulgar fraction?*
What is the number above the line?
What is that below it?
What does the denominator show?
What does the numerator express?
How many kinds of fractions are there?
What is a proper fraction?
What is an improper fraction?
What is a compound fraction?
What is a mixed number?
How do you reduce a fraction to its simplest terms?
How do you find a common divisor, or common measure?
How do you reduce fractions to a common denominator?
How do you reduce a compound fraction to a simple one?
How do you reduce a mixed number to an improper fraction?
How do you reduce an improper fraction to its proper terms?
How do you reduce a fraction from a less to a greater denomination?
How do you reduce a fraction from a greater denomination to a less one.

ADDITION OF VULGAR FRACTIONS.

RULE.

Reduce the given fractions, if necessary, to single ones, or to a common denominator; add all the numerators together, and place the sum over the common denominator.

EXAMPLES.

$\frac{5}{8}$	$4\ \frac{3}{10}$	$6\ \frac{2}{9}$
$\frac{1}{8}$	$3\ \frac{4}{10}$	$3\ \frac{5}{9}$
$\frac{3}{8}$	$7\ \frac{7}{10}$	$7\ \frac{4}{9}$
$\frac{7}{8}$	$3\ \frac{5}{10}$	$8\ \frac{7}{9}$
$\frac{3}{8}$	$7\ \frac{9}{10}$	$2\ \frac{8}{9}$
$\frac{8}{8}$		
$\frac{19}{8}$ or $2\ \frac{3}{8}$	$26\ \frac{8}{10}=26\frac{4}{5}$	$28\ \frac{8}{9}$

NOTE 1.—When the fractions are of different denominators, reduce them to a common denominator, and proceed as above. (See *Note*, page 139.)

4. Add $\frac{3}{4}$, $\frac{7}{8}$, $\frac{11}{12}$, $\frac{5}{16}$, and $\frac{9}{20}$ together.

Result, $3\ \frac{73}{240}$.

960

$\frac{3}{4}$	$240\times\ 3=720$
$\frac{7}{8}$	$120\times\ 7=840$
$\frac{11}{12}$	$80\times 11=880$
$\frac{5}{16}$	$60\times\ 5=300$
$\frac{9}{20}$	$48\times\ 9=432$

$$\left.\begin{array}{r}3172\\ \hline 960\end{array}\right\}=3\ \tfrac{292}{960}=3\ \tfrac{73}{240}.$$

5 Add $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$, $\frac{9}{10}$ and $\frac{11}{12}$ together. Res. $4\ \frac{11}{40}$.

6 Add $\frac{5}{8}$, $\frac{7}{10}$, $\frac{9}{16}$, and $\frac{11}{24}$ together. Res. $2\ \frac{93}{240}$.

7 Add $\frac{1}{2}$, $\frac{1}{10}$, and $\frac{4}{12}$ together. Res. $\frac{728}{960}=\frac{91}{120}$.

8 Add $\frac{2}{3}$ and $\frac{5}{7}$ together. Res. $1\ \frac{8}{21}$.

9 Add $\frac{7}{10}$, $\frac{11}{12}$ and $\frac{4}{9}$ together. Res. $2\ \frac{11}{180}$.

NOTE 2.—When mixed numbers occur, place them as in examples 2 and 3; proceed with the fractions as directed in *Note* 1; and if they amount to one or more integers, carry them to the integers, and proceed as in simple addition.

10 Add $5\frac{2}{3}$, $6\frac{7}{8}$, and $4\frac{1}{2}$ together. Res. $17\frac{1}{24}$.

24

$5\frac{2}{3}$	$8\times2=16$
$6\frac{7}{8}$	$3\times7=21$
$4\frac{1}{2}$	$12\times1=12$
$17\frac{1}{24}$	49

$\left.\begin{matrix}49\\24\end{matrix}\right\}=2\frac{1}{24}$.

11 Add $2\frac{1}{2}$ and $3\frac{2}{4}$ together. Result $6\frac{1}{4}$.

12 Add $7\frac{3}{7}$ and $5\frac{4}{7}$ together. Res. $12\frac{5}{7}$.

13 Add $17\frac{1}{3}$ and $\frac{2}{3}$ together. Res. $18\frac{1}{3}$.

14 Add 4, 6, 9, $\frac{2}{4}$ and $\frac{5}{9}$ together. Res. $20\frac{1}{36}$.

15 Add 5, $7\frac{1}{2}$, $\frac{2}{5}$ and $\frac{7}{11}$ together. Res. $13\frac{59}{110}$.

NOTE 3.—When compound fractions are given, reduce them to single fractions, and proceed as before.

16 Add $\frac{9}{10}$ of $\frac{11}{13}$, $\frac{3}{11}$ of $\frac{6}{14}$, and $\frac{7}{13}$ of $\frac{5}{6}$ together. Res. $1\frac{643}{1245}$.

9240 common denominator

$\frac{9}{10}$ of $\frac{11}{13}=\frac{99}{130}$	$77\times99=7623$
$\frac{9}{11}$ of $\frac{9}{14}=\frac{48}{154}$	$60\times48=2880$
$\frac{7}{13}$ of $\frac{5}{6}=\frac{35}{130}$	$77\times35=2695$
	13198

$\left.\begin{matrix}13198\\9240\end{matrix}\right\}=\frac{1979}{4620}$.

17 Add $\frac{2}{7}$ of $\frac{7}{8}$ and $\frac{4}{6}$ of $\frac{10}{15}$ together. Res. $\frac{27}{42}$.

18 Add $1\frac{3}{5}$, $\frac{4}{5}$ of $\frac{1}{2}$, and $9\frac{3}{20}$ together. Res. $11\frac{1}{20}$.

19 Add $1\frac{9}{10}$, $6\frac{7}{8}$, $\frac{2}{5}$ of $\frac{1}{2}$, and $7\frac{1}{2}$ together. Res. $16\frac{73}{120}$.

NOTE 4.—When the given fractions are of several denominations, reduce them to their proper values or quantities, and add as in the following example.

20 Add $\frac{7}{9}$ of a pound, to $\frac{3}{16}$ of a shilling.

Result 15s. $10\frac{4}{13}$d.

	s.	d.	15
$\frac{7}{9}$ of a £	15	$6\frac{2}{3}$	$5\times2=10$
$\frac{3}{16}$ of a s.	0	$3\frac{3}{5}$	$3\times3=9$
	15	$10\frac{4}{13}$	$\frac{19}{15}\Big\} = 1\frac{4}{13}$

21 Add $\frac{7}{8}$ of a pound, to $\frac{3}{4}$ of a shilling.

Result 18s. 3d.

22 Add $\frac{3}{4}$ of a penny, to $\frac{1}{9}$ of a pound [illegible]. 3d. 1qr. $\frac{2}{3}$.

23 Add $\frac{1}{2}$ lb. troy, to $\frac{7}{12}$ of an ounce.

Res. 6oz. 11dwt. 16grs.

24 Add $\frac{3}{4}$ of a mile, to $\frac{7}{10}$ of a furlong. Res. 6fu. 28p.

25 Add $\frac{1}{3}$ of a yard, to $\frac{2}{3}$ of a foot. Res. 2ft. 2 in.

26 Add $\frac{1}{3}$ of a day, to $\frac{1}{2}$ of an hour. Res. 8h. 30min.

27 Add $\frac{1}{3}$ of a week, $\frac{1}{4}$ of a day, and $\frac{1}{2}$ of an hour together. Res. 2 days, 14 hours, 30min.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.

Prepare the given fractions as in Addition; then subtract the less from the greater, and place the difference over the common denominator.

EXAMPLES.

1 Take $\frac{3}{5}$ from $\frac{4}{5}$. Rem. $\frac{1}{5}$.

2 Take $\frac{1}{13}$ from $\frac{7}{13}$. Rem. $\frac{6}{13}$.

3 Take $\frac{5}{16}$ from $\frac{9}{16}$. Rem. $\frac{2}{5}$.

4 Take $\frac{2}{7}$ from $\frac{3}{7}$. Rem. $\frac{1}{35}$.

	35
$\frac{3}{7}$	$5\times3=15$
$\frac{2}{5}$	$7\times2=14$
	$\frac{1}{35}$

$\frac{5}{7}$ $\frac{2}{7}$ $\frac{7}{7}$ $\frac{3}{7}$

$\frac{11}{12}$ $\frac{5}{12}$ $\frac{6}{12}=\frac{1}{2}$

$\frac{15}{16}$ $\frac{3}{16}$ $\frac{12}{16}=\frac{3}{4}$

$\frac{17}{32}$ $\frac{13}{32}$ $\frac{4}{32}$

12 com denom

$\frac{11}{12}$ $\frac{2}{3}$ $\frac{8}{12}$ $\frac{1}{6}$ Ans.

$1\times11=11$
$4\times2=8$

$\frac{3}{12}=\frac{1}{4}$

60 com. denom.

$\frac{7}{12}$ $\frac{9}{20}$ $\frac{1}{60}$ Ans.

$4\times6=28$
$3\times9=27$

$8\frac{2}{9}$ $6\frac{3}{11}$ $1\frac{94}{99}$

$9\frac{1}{4}$ $4\frac{3}{4}$ $4\frac{9}{36}$

$7\frac{7}{8}$ $3\frac{2}{3}$ $4\frac{5}{24}$

6 $\frac{1}{8}$ $5\frac{7}{8}$

100 $99\frac{88}{100}$ $\frac{1}{100}$

From $\frac{7}{9}$ of a pound take $\frac{3}{10}$ of a shilling.

	s.	d.	15 com denom.
$\frac{7}{9}$ of a pound	=15	$6\frac{2}{3}$	$5\times2=10$
$\frac{3}{10}$ of a shilling	=	$3\frac{3}{5}$	$3\times3=9$
	s. 15	$3\frac{1}{15}$	Ans. $\frac{1}{15}$

From $\frac{3}{4}$ of a £ take $\frac{1}{4}$ of a shilling.

Res. 14s. 3d.

From $\frac{1}{4}$ of a lb. troy, take $\frac{1}{6}$ of an ounce.

Res. 8oz. 16dwt. 16grs.

From $\frac{1}{6}$ of a yard take $\frac{1}{3}$ of an inch. Res. 5in. $\frac{1}{3}$.

From $\frac{1}{3}$ of a £ take $\frac{1}{3}$ of $\frac{1}{4}$ of a shilling.

Res. 10s. 7d. 1qr. $\frac{1}{3}$.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.

Prepare the given fractions, if necessary; then multiply the numerators together for a new numerator, and the denominators together for a new denominator.

EXAMPLES.

1 Multiply $\frac{4}{9}$ by $\frac{3}{16}$. Res. $\frac{1}{12}$.

$\frac{4}{9}\times\frac{3}{16}=\frac{12}{144}=\frac{1}{12}$

2 Multiply $\frac{1}{12}$ by $\frac{3}{5}$. Res. $\frac{1}{20}$.

3 Multiply $\frac{6}{7}$ by $1\frac{8}{9}$. Res. $2\frac{24}{63}$, or $2\frac{8}{21}$.

4 Multiply $12\frac{3}{5}$ by $7\frac{2}{3}$. Res. $96\frac{3}{5}$.

$12\frac{3}{5}=\frac{63}{5}$ and $7\frac{2}{3}=\frac{23}{3}$; then $\frac{63}{5}\times\frac{23}{3}=\frac{1449}{15}=96\frac{9}{15}$.

5 Multiply $7\frac{1}{3}$ by $8\frac{1}{2}$. Res. $62\frac{5}{6}$.

6 Multiply $4\frac{1}{2}$ by $\frac{1}{8}$. Res. $\frac{9}{16}$.

7 Multiply $\frac{7}{8}$ by $13\frac{9}{10}$. Res. $12\frac{13}{80}$.

8 Multiply $\frac{1}{3}$ of $\frac{4}{5}$ by $\frac{7}{10}$ of $\frac{11}{12}$. Res. $\frac{77}{450}$.

9 Multiply $4\frac{3}{4}$ by $\frac{2}{3}$ of $\frac{3}{4}$. Res. $2\frac{3}{4}$.

10 Multiply $\frac{1}{7}$ of 7 by $\frac{3}{4}$. Res. $1\frac{3}{4}$.

11 Multiply $2\frac{1}{3}$ by $1\frac{1}{7}$, and multiply the product by $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{2}{3}$. Res. $\frac{2}{3}$.

DIVISION OF VULGAR FRACTIONS.

RULE.

Prepare the given fractions, if necessary, then invert the divisor, and proceed as in Multiplication.

EXAMPLES.

1 Divide $\frac{4}{9}$ by $\frac{7}{8}$. Res. $\frac{32}{63}$.

$8\times4=32$

$7\times9=63$

2 Divide $\frac{4}{7}$ by $\frac{2}{3}$. Res. $\frac{6}{7}$.

3 Divide $\frac{1}{2}\frac{7}{1}$ by $\frac{3}{5}$. Res. $1\frac{22}{63}$.

4 Divide $1\frac{1}{2}$ by $4\frac{6}{10}$. Res. $\frac{6}{11}$.

5 Divide $3\frac{1}{6}$ by $9\frac{1}{2}$. Res. $\frac{1}{3}$.

6 Divide $\frac{7}{8}$ by 4. Res. $\frac{7}{32}$.

7 Divide 4 by $\frac{7}{8}$. Res. $4\frac{4}{7}$.

8 Divide $\frac{1}{2}$ of $\frac{2}{3}$ by $\frac{2}{3}$ of $\frac{3}{7}$. Res. $\frac{7}{9}$.

9 Divide $\frac{1}{2}$ of 19 by $\frac{2}{3}$ of $\frac{3}{4}$. Res. $7\frac{2}{3}$.

10 Divide $4\frac{5}{9}$ by $\frac{5}{9}$ of 4. Res. $2\frac{1}{20}$.

11 Divide $\frac{2}{3}$ of $\frac{1}{3}$ by $\frac{5}{7}$ of $7\frac{2}{5}$. Res. $\frac{7}{111}$.

12 Divide $5205\frac{1}{5}$ by $\frac{4}{5}$ of 91. Res. $71\frac{1}{4}$.

DECIMAL FRACTIONS.

A decimal fraction is a fraction whose denominator is 1, with as many cyphers annexed as there are figures in the numerator, and is usually expressed by writing the numerator only with a point prefixed to it: thus $\frac{5}{10}$, $\frac{75}{100}$, $\frac{625}{1000}$, are decimal fractions, and are expressed by .5 .75, .625.

A mixed number, consisting of a whole number and a decimal, as $25\frac{5}{10}$, is written thus, 25.5.

As in numeration of whole numbers the values of the figures increase in a tenfold proportion, from the right hand to the left; so in decimals, their values decrease in the same proportion, from the left hand to the right which is exemplified in the following

TABLE.

Hundred Million.	Ten Million.	Million.	Hundred thousand.	Ten thousand.	Thousand.	Hundred.	Ten.	Unit.	.	Tenth.	Hundredth.	Thousandth.	Ten thousandth.	Hundred Thousandth.	Millionth.	Ten Millionth.	Hundred Millionth.	Thousand Millionth.
1	1	1	1	1	1	1	1		.	1	1	1	1	1	1	1	1	1
Whole numbers.										Decimals.								

NOTE.—Cyphers annexed to Decimals, neither increase nor decrease their value; thus, .5, .50, .500, being $\frac{5}{10}$, $\frac{50}{100}$, $\frac{500}{1000}$, are of the same value: but cyphers prefixed to decimals, decrease them in a tenfold proportion; thus .5, .05, .005; being $\frac{5}{10}$, $\frac{5}{100}$, $\frac{5}{1000}$, are of different values.

ADDITION OF DECIMALS.

RULE.

Place the given numbers according to thoir values, viz. units under units, tenths under tenths, &c., and add as in addition of whole numbers; observing to set the point in the sum exactly under those of the given numbers.

EXAMPLES.

.12	2.16	.14	.1	.15
.134	3.45	.24	4.12	.75
.21	40.02	.122	15.4	.92
743	35.4	.36	76.36	63.25
345	36.1	.141	120.16	25.
.002	125.32	.567	425.04	4.
1.554	242.45			

6 Add .5, .75, .125, 496, and .750 together.

7 Add .15, 126.5, 650.17, 940.113, and 722.2560 together.

8 Add 420., 372.45, .270, 965.02, and 1.1756 together.

SUBTRACTION OF DECIMALS.

RULE.

Place the numbers as in addition, with the less under the greater, and subtract as in whole numbers; setting the point in the remainder under those in the given numbers.

EXAMPLES.

.4562	56.12	.4314	5672.1	32.456
.316	1.242	.312	321.12	1.33
.1402	54.878			

6 From 100.17 take 1.146.

7 From 146.265 take 45.3278.

8 From 4560. take .720.

MULTIPLICATION OF DECIMALS.

RULE.

Multiply as in whole numbers, and from the right hand of the product, separate as many figures for decimals, as there are decimal figures in both the factors.

EXAMPLES.

1 Multiply .612 by 4.12

.612
4.12

1224
612
2448

2.52144

2 Multiply 1.007 by .041.

1.007
.041

1007
4028

.041287

3	Multiply	37.9 by 46.5	Product 1762.35
4		36.5 by 7.27	265.355
5		29.831 by .952	28.399112
6		3.92 by 196.	768.32
7		.285 by .003	.000855
8		4.001 by .004	.016004
9		.00071 by .121	.00008591

DIVISION OF DECIMALS.

RULE.

Divide as in whole numbers, and from the right hand of the quotient, separate as many figures for decimals as the decimal figures of the dividend exceed those of the divisor. If there are not so many figures as the rule requires, supply the defect by prefixing cyphers.

EXAMPLES.

1 Divide .863972 by .92

.92).863972(.9391
828

359
276

837
828

92
92

2 Divide 4.13 by 572.4.

572.4)4.130000(.00721+
40068

12320
11448

8720
5724

2996

3	Divide 19.25 by 38.5	Quotient	.5
4	234.70525 by 64.25		3.653
5	1.0012 by .075		13.34+
6	.1606 by .44		.365
7	.1606 by 4.4		.0365
8	.1606 by 44.		.00365
9	9. by .9		10.
10	.9 by 9.		.1
11	186.9 by 7.476		25.

NOTE 1. When a whole number is to be divided by a greater whole number, cyphers must be affixed to the dividend, as decimal figures.

12	Divide 3 by 4	Quotient	.75
13	275 by 3842		.071577+
14	210 by 240		.875

NOTE 2. When any whole number is divided by another, if there be a remainder, cyphers may be affixed to the dividend, and the quotient continued.

15	Divide 382 by 25	Quotient	15.28
16	13689 by 75		182.52
17	315 by 124		2.5403+

REDUCTION OF DECIMALS.

Case 1.

To reduce a vulgar fraction to a decimal.

RULE.

Place cyphers to the right of the numerator, until you can divide it by the denominator, and continue to divide until there is no remainder left; or if it be a number which will never come out without a remainder, until it is carried out to a convenient number of decimal places.

EXAMPLES.

1 Reduce $\frac{4}{5}$ to a decimal.

5)40

.8 Ans.

2 Reduce $\frac{7}{8}$ to a decimal. Ans. .875.

3 Reduce $\frac{17}{24}$ to a decimal. Ans. .70833.+

4 Reduce $\frac{261}{1125}$ to a decimal. Ans. .1762.+

5 Reduce $\frac{115}{264}$ to a decimal. Ans. .4566.+

Case 2.

To reduce any given sum or quantity to the decimal of any higher given denomination.

RULE.

Reduce the given sum or quantity to the lowest denomination mentioned in it.

Reduce one of that denomination of which you wish to make it a decimal, to the same denomination with the given sum.

Divide the given quantity so reduced by one of the denomination of which you wish to make it a decimal; the quotient will be the decimal required.

EXAMPLES.

1 Reduce 3s. 6d. to the decimal of a pound.

3s. 6d.= 42
£1. =240

240)42.000(.175 decimals, **Ans.**
240

1800
1680

1200
1200

2 Reduce 2R. 4P. to the decimal of an acre.

Answer, .525.

3 Reduce 2 qr. 2 nails to the decimal of a yard.

Ans. .625.

4 Reduce 5 minutes to the decimal of an hour.

Ans. .08333.

5 Reduce 10 grains to the decimal of an ounce, apothecaries' weight. Ans. .02083.+

6 Reduce 2 quarts 1 pint to the decimal of a hogshead. Ans. .00992.+

CASE 2.

To reduce a decimal fraction to its proper value.

RULE.

Multiply the given fraction continually by the denomination next lower than that of which it is a decimal, for the proper value.

EXAMPLES.

1 What is the value of .375 of a dollar? **Ans.** 37½cts.

.375
100

37.500
10

5.000

2 What is the value of .1361 of a £.? Ans. 2s. 8½d.

3 What is the value of .235 of a day?
Ans. 5 hours, 38 min. 24 sec.
4 What is the value of .42 of a gallon?
Ans. 1 quart, 1.36 pt.
5 What is the value of .253 of a shilling? Ans. 3.036d.
6 What is the value of .436 of a yard?
Ans. 1 qr. 2.976 na.
7 What is the value of .9 of an acre?
Ans. 3R. 24P.

PROPORTION IN DECIMALS.

RULE.

State the question as the rule of three, in whole numbers, only observe, when you multiply and divide, to place the decimal points according to the rules of multiplication and division of decimals.

EXAMPLES.

1 If 4.2lb of coffee cost 8s. 2.3d., what cost 639.25lb.?

lb.	*lb.*	*s.*	*d.*	£	*s.*	*d.*	
4.2	: 639.25 : :	8	2.3	: 62	6	9.49	Ans.

2 When 1.4 yard cost 13s. what will 15 yards come to at the same price? Ans. £6 19s. 3d. 1.71 qr.
3 If I sell 1 qr. of cloth for 2 dollars 34.5 cents, what is it per yard? Ans. $9 38 cts.
4 A merchant sold 10.5 cwt. of sugar, for 108.30 dollars, for which he paid 84 dollars 39.12 cents; what did he gain per cwt. by the sale? Ans. $2 27 cts. 7m.+
5 How many pieces of cloth, at 20.8 dollars per piece, are equal in value to 240 pieces, at 12.6 dollars per piece? Ans. 145.38+ pieces.
6 If, when the price of wheat is 74.6 cents per bushel, the penny roll weighs 5.2 oz., what should it be per bushel when the penny roll weighs 3.5 oz.?
Ans. $1 10 cts. 8m.+

Question.

How do you perform operations in the rule of three

COMPOUND PROPORTION, IN DECIMALS.

Questions in this rule are wrought as in whole numbers, placing the points agreeably to former directions.

EXAMPLES.

1 If 3 men receive 8.9£ for 19.5 days labor, how much must 20 men have for 100.25 days?

Ans. 305£. 0s. 8.2d.

men } 3 : 20
days } 19.5 : 100.25 days } :: 89£. : 305£. 0s. 8.2d.

2 If 2 persons receive 4.625s. for 1 day's labor, how much should 4 persons have for 10.5 days?

Ans. 4£. 17s. 1½d.

3 If the interest of 76.5£ for 9.5 months, be 15.24£. what sum will gain 6£ in 12.75 months?

Ans. 22£ 8s. 9½d.

4 How many men will reap 417.6 acres in 12 days, if 5 men reap 52.2 acres in 6 days? Ans. 20 men.

5 If a cellar 22.5 feet long, 17.3 feet wide, and 10.25 feet deep, be dug in 2.5 days, by 6 men, working 12.3 hours a day, how many days of 8.2 hours, should 9 men take to dig another, measuring 45 feet long, 34.6 wide, and 12.3 deep? Ans. 12 days.

MENSURATION.

MENSURATION is employed in measuring masons' and carpenters' work, plastering, painting and paving; also, for measuring timber in all its forms, and for estimating quantity in length, superfices, and solids, whenever yards, feet, inches, &c., are employed.

The denominations are, foot, inch, second, third, and fourth,

12 Fourths''''	one 1 Third'''
12 Thirds	one 1 Second''
12 Seconds	one 1 Inch. *I.*
12 Inches	one 1 Foot. *Ft.*

ADDITION.

RULE.

Proceed as in Compound Addition.

EXAMPLES.

Ft.	I.	"
25	6	3
14	2	9
35	11	10
45	10	11
6	0	0
4	9	0
132	4	9

Ft.	I.	"
72	4	6
54	3	2
14	0	8
26	3	2
19	0	4
14	0	0

Ft.	I.	"	"'	""
17	9	2	3	11
18	11	10	8	9
22	11	5	4	9
14	10	11	10	8
12	0	0	4	10
10	2	8	4	0

4 Four floors in a certain building contain each 1084 feet, 9in. 8″; how many feet are there in all?

Ans. 4339ft. 2 in. 8″.

5 There are six mahogany boards, the first measures 27 ft. 3in., the second 25 ft. 11in., the third, 23ft. 10in., the fourth 20ft. 9in., the fifth 20ft. 6in., and the sixth 18 feet 5 in.; how many feet do they contain?

Ans. 136ft. 8in.

SUBTRACTION.

RULE.

Proceed as in Compound Subtraction.

EXAMPLES.

Ft.	I.	"
75	9	9
14	6	11
61	2	10

Ft.	I.	"
84	6	4
72	8	8

Ft.	I.	"	"'	""
100	10	8	10	11
97	2	4	6	8

4 If 19ft. 10in. be cut from a board which contains 41ft. 7in. how much will be left? Ans. 21ft. 9in.

5 Bought a raft of boards containing 59621ft. 8in., of which are since sold 3 parcels, each 14905ft. 5in.; how many feet remain? Ans. 14905ft. 5in.

MULTIPLICATION.

Case 1.

When the feet of the multiplier do not exceed 12.

RULE.

Set the feet of the multiplier under the lowest denomination of the multiplicand, as in the following example; then multiply as in Compound Multiplication, by each denomination of the multiplier separately, observing to place the right hand figure, or number, of each product, under that denomination of the multiplier by which it is produced.

EXAMPLES.

1 Multiply 10 feet 6 inches by 4 feet 6 inches.
Product 47 feet, 3 in.

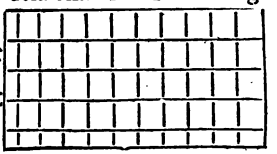
Ft.	*I.*	″	
10	6		
	4	6	
5	3	0	A table 10 feet 6 inches long, and 1 foot wide, will make 10 feet 6 inches, or 10½ feet, square measure.
42	0		And 4 feet 6 inches, or 4½ feet wide, will make 4½ times 10½, or
47	3	0	47¼ feet, or 47 feet 3 inches.

OR THUS:

ft.	*in.*	
10	6	
	4½	ft.
5	3	
42	0	
47	3	

NOTE 1.—If there are no feet in the multiplier, supply their place with a cypher; and in like manner supply the place of any other denomination between the highest and lowest.

10ft. 6in. or 10½ feet long.



4 times 10½ make 42ft.
and ½time 10½ make 5¼ ft.
Added, make 47¼.

		Ft.	I.	"		Ft.	I.			Ft.	I.	"	'''
2	Multiply	9	7		by	3	6		Res.	33	6	6	
3		3	11		by	9	5			86	10	7	
4		8	6	9	by	7	3	8		62	6	7	9
5		28	10	6	by	3	2	4		92	2	10	6

Case 2.

When the feet of the multiplier exceed 12.

RULE.

Multiply by the feet of the multiplier as in Compound Multiplication, and take parts for the inches, &c.

EXAMPLES.

1 Multiply 112ft. 3in. 5″ by 42ft. 4in. 6″

Ft.	I.	"				
112	3	5				
		6×7=42				
673	8	6				
		7				
I.						
4 ½	4715	11	6	'''	''''	
"	37	5	1	8		
6 ½	4	8	1	8	6	
4758	0	9	4	6		

		Ft.	I.	"		Ft.	I.	"		Ft.	I.	"	'''
2	Multiply	76	7		by	19	10		Res.	1518	10	10	
3		127	6		by	184	8			23545	0	0	
4		71	2	6	by	81	1	8		5777	9	2	2

APPLICATION.

1 A certain board is 28ft. 10in. 6″ long, and 3ft. 2 in. 4″ wide; how many square feet does it contain?

Ans. 92ft. 2in. 10‴ 6⁗.

2 If a board be 23ft. 3in. long, and 3ft. 6in. wide, how many square feet does it contain?

Ans. 81ft. 4in. 6″.

3 A certain partition is 82ft. 6in. by 13ft. 3in.; how many square feet does it contain? Ans. 1093ft. 1in. 6″.

4 If a floor be 79ft. 8in. by 38ft. 11in., how many square feet are therein? Ans. 3100ft. 4in. 4″.

NOTE.—Divide the square feet by 9, and the quotient will be square yards.

5 If a ceiling be 59ft. 9in. long, and 24ft. 6in. broad, how many square yards does it contain?

Ans. 162yd. 5ft.+

6 in. | ½ |

	Ft.	I.	
	59	9	
		3	
	179	3	
		8	
	1434	0	
	29	10	6
9)	1463	10	6

162yd. 5 ft.

6 How many yards are contained in a pavement 56 feet 9 inches long, and 18 feet 4 inches wide?

Ans. 115yd. 5ft. 5in.

7 How many yards in a ceiling 92ft. 4in. long, 22ft. 8in. wide? Ans. 232yd. 4ft. 10in.+

8 How many squares in a floor 37ft. 6in. long, and 21ft. 9in. wide? Ans. 8 squares, 15 feet.+

A square is 10 feet long and 10 feet wide, or 100 square feet. It is used in estimating flooring, roofing, weather-boarding, &c.

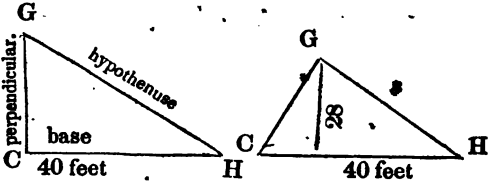
9 How many squares of weather-boarding on the side of a house 43 feet 6 in. long, and 18ft. 8in. high?

Ans. 8 squares, 12ft.

10 How many squares in a roof 26ft. 4in. long, 15ft. 9in. wide? Ans. 5 sq. 72ft.+

NOTE 2.—*To measure a triangle.* Multiply the base by one half the perpendicular height, and the product will be its superficial content.

11 Let C, H, and G, represent a triangle, whose base is 40 feet, and perpendicular height 28 feet; how many feet does it contain? Ans. 560 feet.



feet.

40

14 half the perpendicular

160

40

560

12 How many square feet in a triangle 80 feet long and 36 feet high? Ans. 1440 ft.

13 In a triangular pavement 46 feet long, and 34 feet at the place of its greatest width, how many yards; and how many bricks, allowing 41 to every square yard?

Ans. 61yd. 3ft., and 2514 bricks.

14 In the gable ends of a house, which is 63 feet long and 22 feet high, from the "square of the building" to the top, how many squares? Ans. 6sq. 93in.

NOTE 3.—*To find the circumference of a circle, when the diameter is given:* Say,

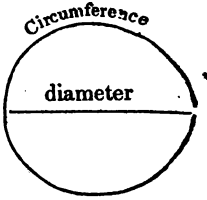
As 7 are to 22, so is the diameter to the circumference; *or the contrary,*

As 22 are to 7, so is the circumference to the diameter.

The diameter of a circle is 14 set; what is the circumference?
Ans. 44.

As 7 : 22 : : 14 : 44

The circumference of a circle s 44ft.; what is the diameter?
Ans. 14.



NOTE 4.—*To find the superficial contents of a circle.* Multiply half the circumference by half the diameter

15 How many square feet in a circle whose diameter is 14 feet, and circumference 44? Ans 154 ft.

half circumference, 22
half diameter, 7

154 feet

16 How many square feet in a circle whose circumference is 16 feet? Ans. 20 sq. ft.

As 22 : 7 : : 16 : 5

half cir. 8
half diam. 2½
—20

17 How many square feet in a circle whose diameter is 21 feet? Ans. 346½ ft.

NOTE 5.—*To find the superficial contents of a globe.* Multiply the circumference by the diameter.

18 What are the superficial contents of a globe whose diameter is 70 feet, and circumference 220 feet?
Ans. 15400 sq. ft.

19 How many square yards of cloth would be required to cover a globe, whose diameter is 28 feet, and circumference 88? Ans. 2464 ft.

20 How many yards of canvass would be required to make a balloon of a globular form, 20 feet in diameter?
Ans. 1257 sq. yds.

NOTE 6.—*To find the solid contents of a cube,* or of a square stick of timber, or a pile of wood, &c.* Multiply the length by the breadth, and that product by the thickness.

* A *cube* is a solid body, contained by 6 equal sides, all of which are exact squares.

21 What are the solid contents of a cube whose diameter is 4 feet? Ans. 64 feet.

4 feet
4
16
4
64

22 What is the solid contents of a stick of timber 2 feet thick, 3 feet wide, and 36 feet long?

Ans. 216 solid feet.

36 feet
3
108
2
216

23 How many solid feet in a block of marble 3 feet thick, 7 feet wide, and 13 feet long? Ans. 273 sol. ft.

24 In a cube whose diameter is 7 feet, how many solid feet? Ans. 343 feet

25 How many solid feet in a pile of wood 28 feet long, 8 feet wide, and 10 feet high; and how many cords does it contain? Ans. 2240 feet; 17 cords 64 ft. or, 17½ cords.

26 In a cellar 36 feet long, 27 feet wide, and 4½ feet deep, how many solid yards? Ans. 162 yards

27 How many perches* of stone in a wall 42 feet long, 8½ feet high, and 2 feet thick? Ans. 27,8 perches

feet
25,75)714.00(27,8.

28 In a 13 inch brick wall, 52 feet long and 36 feet high, how many bricks, allowing 21 to every square foot of wall? Ans. 39312.

* A perch is 16½ feet long, 1½ ft. wide, and 1 foot high, or 25¼ solid feet.

29 In an 8 inch brick wall, 82 feet long and 16 feet high; how many bricks, allowing 14 bricks for every square foot of wall? Ans. 18368.

30 In a 16 inch brick wall, 148 feet long and 42 feet high, how many bricks, allowing 28 bricks to the square foot? Ans. 174048.

31 How many bricks in 3 walls, the first 68 feet long, 18 feet 6 inches high, 16 inches thick; the second 72 ft. 6in. long, 19ft. 4in. high, 12in. thick; the third 43ft. 4in. long, 12ft. 8in. high, 8in. thick? Ans. 72343.+

NOTE 7.—*To find the solid contents of a cylinder.**—Find the contents of one end by *Note* 4, and multiply that product by the length.

32 What are the solid contents of a cylinder whose diameter is 14 feet, and length 16 feet? Ans. 2464ft.

half circumference	22
half diameter	7
	154
	16
	924
	154
	2464 feet

33 What are the contents of a circular well, 7 feet in diameter, and 62 feet deep? Ans. 2387 ft.

34 What are the solid contents of a tub whose diameter is 6 feet and height 7 feet? Ans. 198 ft.

35 How many yards in a circular well, 10 feet diameter and 20 feet deep? Ans. $1571\frac{3}{7}$ ft.

NOTE 8.—*To find the contents of a cistern whose top and bottom are of different diameters.* To three times the product of the two diameters, in inches, add the square of their difference; multiply the sum by one third of the depth, and divide the product by 359,05 for ale; 294,12 for wine measure, and 2788 for malt bushels, and the quotient will be the content accordingly.

* A cylinder is a long round body, whose diameter is every where the same.

EXAMPLES.

1 Suppose the greater diameter 80 inches, and ıe less diameter 71 inches, and the depth 34 inches, 'hat is the content in ale—and also in wine gallons?

Ans. {540.42 A. G. / 659.72 W. G.

2 The greater diameter of a vessel is 38 inches, the less 0.2 inches, and the depth 21 inches; what is the con- ɜnt in ale gallons? Ans. 51.07 gal.

3 The top diameter of a vessel is 22in., bottom 40in., nd the depth 60in.; what is the content in ale gallons, nd in wine gallons; also in malt bushels.

Ans. {165.12 A. G. / 201.55 W. G. / 21.63 Malt bu.

4 How many barrels of 33 gallons each, are contained ı a cistern whose bottom diameter is 8ft. 6in., top 8ft., nd the depth 7ft. 9in. Ans. 76 bbls. 18 gal. ale meas.

ɜreater diam.	102 inches	102
ɜess diam.	96	96
	6	612
	6	918
lqr. of dif.	36.	9792
		3
		29376
		36 sqr. of dif.
		29412
		31 one third of depth.
		29412
		88236

gal.
33)2536(76 bbls.
231
226
208
18 gallons.

359.05)911772(2536+gallons.

NOTE 9.—*To find the solid contents of a round stick of timber of a taper from one end to the other.* Find the circumference a little nearer the larger than the smaller end; from this, by *Note* 3, find the diameter: multiply half the diameter by half the circumference, and the product by the length.*

EXAMPLES.

1 What are the solid contents of a round stick of timber 10 feet long, and 2.61 feet circumference?

Ans, 5.4 feet.+

As 22 : 7 : : 2.61 : .83 diameter
1,305 half circumference
.415 half diameter

6525
1305
5220

.541575
10 length

5.415750

2 How many solid feet in a log 40 feet long, which girts 66 inches? Ans. 96.25 ft.

As 22 : 7 : : 66 : 21 in diameter

$33 \times 10\frac{1}{2} \times 40 = 13860.$ 144)13860(96.25

NOTE 10.—*To find the solid contents of a globe.*—Multiply the cube of the diameter by .5236.

EXAMPLES.

1 What are the solid contents of a globe whose diameter is 14 inches? Ans. 1436.75in.+

$14 \times 14 \times 14 = 2744.$ $2744 \times .5236 = 1436.7584.$

2 What are the contents of a balloon of a globular form, 42 feet in diameter? Ans. 38792.4 ft.+

3 How many solid miles are contained in the earth, or globe, which we inhabit?

* This method, though not quite accurate, is sufficiently near the truth for the purpose of measuring timber.

Suppose the diameter to be 7954 miles; then, 7954×7954×7954=503218686664 the cube of the earth's axis, or diameter; then,

503218686664×.5236=263485304337 cubick miles. Ans.

NOTE.—The solidity of a globe may be found by the circumference, thus—Multiply the cube of the circumference by .016887—the product will be the contents.

INVOLUTION, OR THE RAISING OF POWERS.

The product arising from any number multiplied by itself, any number of times, is called its *power*, as follows:

2×2= 4 the square, or 2d power of 2.
2×2×2= 8 3d power or cube of 2.
2×2×2×2=16 4th power of 2.

The number which denotes a power is called its index.

NOTE.—When any power of a vulgar fraction is required, first raise the numerator to the required power, and then the denominator to the required power, and place the numerator over the denominator as before: thus, the 4th power of $\frac{2}{3}$ $\frac{2\times2\times2\times2}{3\times3\times3\times3}=\frac{16}{81}$

Questions.

What is the product, arising from the multiplication of any figure by itself a given number of times, called?

What is the number which denotes a power, called?

How do you proceed to find any required power of a vulgar fraction?

Table of the first nine Powers.

Roots.	Squares.	Cubes	4th power.	5th power.	6th power.	7th power.	8th power.	9th power.
1	1	1	1	1	1	1	1	1
2	4	8	16	32	64	128	256	512
3	9	27	81	243	729	2187	6561	19683
4	16	64	256	1024	4096	16384	65536	262144
5	25	125	625	3125	15625	78125	390625	1953125
6	36	216	1296	7776	46656	279936	1679616	10077696
7	49	343	2401	16807	117649	823543	5764801	40353607
8	64	512	4096	32768	262144	2097152	16777216	134217728
9	81	729	6561	59049	531441	4782969	43046721	387420489

EXAMPLES.

1 What is the square of 32?

32
32
—
64
96
—
1024 Ans.

2 What is the cube of 14? Ans. 2744.

14
14
—
56
14
—
196
14
—
784
196
—
2744

3 What is the sixth power of 2.8? Ans 481.890304

4 What is the third power of .263? Ans, .018191447.

EVOLUTION, OR THE EXTRACTING OF ROOTS.

The root of a number, or power, is such a number, as being multiplied into itself a certain number of times, will produce that power, Thus 2 is the square root of 4, because $2\times2=4$; and 4 is the cube root of 64, because $4\times4\times4=64$, and so on.

THE SQUARE ROOT.

The square of a number is the product arising from that number multiplied into itself.

Extraction of the square root is the finding of such a number, as being multiplied by itself, will produce the number proposed. Or, it is finding the length of one side of a square.

RULE.

1 Separate the given number into periods of two figures, each, beginning at the units place.

2 Find the greatest square contained in the left hand period, and set its root on the right of the given number: subtract said square from the left hand period, and to the remainder bring down the next period for a dividual.

3 Double the root for a divisor, and try how often this divisor (with the figure used in the trial thereto annexed) is contained in the dividual: set the number of times in the root; then, multiply and subtract as in division, and bring down the next period to the remainder for a new dividual.

4 Double the ascertained root for a new divisor, and proceed as before, till all the periods are brought down.

NOTE.—If, when all the periods are brought down, there be a remainder, annex cyphers to the given number, for decimals, and proceed till the root is obtained with a sufficient degree of exactness.

Observe that the decimal periods are to be pointed off from the decimal point toward the right hand: and that there must be as many whole number figures in the root, as there are periods of whole numbers, and as many decimal figures as there are periods of decimals.

PROOF.

Square the root, adding in the remainder, (if any,) and the result will equal the given number.

EXAMPLES.

1 What is the square root of 5499025?

```
     5,49,90,25(2345 Ans.
     4                          2345
     ----                       2345
  43)149                       -----
     129                       11725
     ----                      9380
 464)2090                     7035
     1856                    4690
     -----                   -------
4685)23425                   5499025 Proof.
     23425
```

2 What is the square root of 106929? Ans. 327.
3 What is the square root of 451584? Ans. 672.
4 What is the square root of 36372961? Ans. 6031.
5 What is the square root of 7596796?
Ans. 2756.228+
6 What is the square root of 3271.4007?
Ans. 57.19+
7 What is the square root of 4.372594?
Ans. 2.091+
8 What is the square root of 10.4976? Ans. 3.24.
9 What is the square root of .00032754?
Ans. .01809+
10 What is the square root of 10? Ans. 3.1622+

To extract the Square Root of a Vulgar Fraction.

RULE.

Reduce the fraction to its lowest terms, then extract the square root of the numerator for a new numerator, and the square root of the denominator for a new denominator.

NOTE.—If the fraction be a surd, that is, one whose root can never be exactly found, reduce it to a decimal, and extract the root therefrom.

EXAMPLES.

1 What is the square root of $\frac{7056}{9216}$? Ans. $\frac{7}{8}$.
2 What is the square root of $\frac{2704}{4225}$? Ans. $\frac{4}{5}$.
3 What is the square root of $\frac{478}{549}$? Ans. .93309+

To extract the Square Root of a Mixed Number.

RULE.

Reduce the mixed number to an improper fraction, and proceed as in the foregoing examples: or,

Reduce the fractional part to a decimal, annex it to the whole number, and extract the square root therefrom.

EXAMPLES.

1 What is the square root of $37\frac{36}{49}$? Ans. $6\frac{1}{7}$.
2 What is the square root of $27\frac{9}{16}$? Ans. $5\frac{1}{4}$.
3 What is the square root of $85\frac{14}{15}$? Ans. 9.27+

APPLICATION.

1 The square of a certain number is 105625: what is that number? Ans. 325.

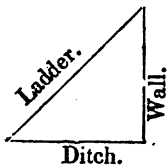
2 A certain square pavement contains 20736 square stones, all of the same size; what number is contained in one of its sides? Ans. 144.

3 If 484 trees be planted at an equal distance from each other, so as to form a square orchard, how many will be in a row each way? Ans. 22.

4 A certain number of men gave 30s. 1d. for a charitable purpose; each man gave as many pence as there were men: how many men were there? Ans. 19.

5 The wall of a certain fortress is 17 feet high, which is surrounded by a ditch 20 feet in breadth; how long must a ladder be to reach from the outside of the ditch to the top of the wall? Ans. 26.24+feet.

NOTE.—The square of the longest side of a right angled triangle is equal to the sum of the squares of the other two sides; and consequently, the difference of the square of the longest, and either of the other, is the square of the remaining one.



6 A certain castle which is 45 yards high, is surrounded by a ditch 60 yards broad; what length must a ladder be to reach from the outside of the ditch to the top of the castle? Ans. 75 yards.

7 A line 27 yards long, will exactly reach from the top of a fort to the opposite bank of a river, which is known to be 23 yards broad; what is the height of the fort? Ans. 14.142+yards.

8 Suppose a ladder 40 feet long be so planted as to reach a window 33 feet from the ground, on one side of the street, and without moving it at the foot, will reach a window on the other side 21 feet high; what is the breadth of the street? Ans. 56.64+feet.

9 Two ships depart from the same port; one of them sails due west 50 leagues, the other due south 84 leagues; how far are they asunder??

Ans. 97.75+ Or, 97¾+leagues.

Questions.

What is a *square?* A square is a surface whose length and breadth are equal, and whose angles (or corners) are right angles, (or square.)

What is its *square root?* The square root is the length of the side of a square.

If the square be *sixteen*, what is the root?

Why is the root four?

If the root be *three*, what is the SQUARE?

What is the *square root* of twenty-five?

What is the square of five?

What is the square root of thirty-six?

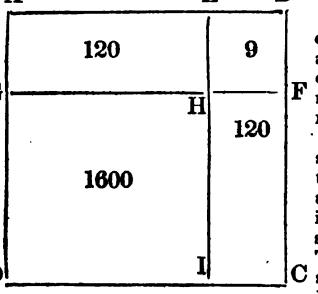
What is the square of six?

How do you point off a number whose square root is to be extracted?

What is the next step? What do you subtract from the period? What do you annex to the remainder?

Illustration of the Rule for extracting the Square Root.

The reason for pointing off the given number into periods of *two* figures each, is, that the product of any whole number contains just as many figures as are in both the multiplier and the multiplicand, or but *one* less; consequently, the square contains just double as many figures as the root, or *one* less.



Suppose the figure ABCD contains 1849 square feet, and that the number consists of two periods; then there must be two figures in the root.

The largest root whose square can be taken out of the left hand period, is 4, (or as it will stand in ten's place in the root, it is 40,) and the square of this is 16 (or 1600.) This taken from the whole square ABCD, or 1849, leaves 249.

18,49(43
16

83)249
249

...

Now double GH or HI, which is 40, for a divisor, omitting the cypher to leave place for the next quotient figure, to complete the divisor.

80 into 249 are contained 3 times; this 3 is the width of the oblong AEHG, or HFCI. But the square is imperfect without EBFH; then annex the three to the divisor. Now multiply this perfect divisor by the last figure of the root, to get the quantity in the two oblong figures, and the small square which comprises the great square ABCD.

GHID	=	1600
AEHG	=	120
HFCI	=	120
EBFH	=	9
ABCD	=	1849

How do you find the divisor?

Why do you place the new quotient figure in the units place of the divisor?

How do you prove the square root?

THE CUBE ROOT.

The cube of a number is the product of that number multiplied into its square?

Extraction of the cube root is finding such a number as, being multiplied into its square, will produce the number whose cube root is extracted.

RULE.

Separate the given number into periods of three figures each, beginning at the units place. Find the greatest *cube* in the left hand period, and set its *root* in the quotient; subtract said cube from the period, and to the remainder bring down the next period for a dividual.

Square the root, and multiply the square by *three hundred* for a divisor.

See how often the divisor is contained in the dividual, and place the result in the quotient.

Multiply the divisor by the last found quotient figure; square the last found figure—multiply the square by the preceding figure or figures of the quotient, and this product by *thirty;* and cube the last figure. Add these three products together, and subtract their amount from the dividual.

To the remainder add the next period, and proceed as before, until the periods are all brought down.

When a remainder occurs, annex periods of cyphers to obtain decimals, which may be carried to any convenient number.

NOTE 1.—The cube root of a vulgar fraction is found by reducing it to its lowest terms, and extracting the root of the numerator for a numerator, and of the denomina-

or for a denominator. If it be a surd,* extract the root of its equivalent decimal.

EXAMPLES.

1 What is the cube root of 99252847?

99,252,847(463 Ans. 463.

$4\times4\times4=64$

$4\times4\times300=4800$	35252	463
		463
Div. $4800\times6=$	28800	
$6\times6\times4\times30=$	4320	1389
$6\times6\times6=$	216	2778
		1852
Subtrahend	33336	
		214369
$46\times46\times300=634800$	1916847	463
Div. $634800\times3=$	1904400	643107
$3\times3\times46\times30=$	12420	1286214
$3\times3\times3=$	27	857476
Subtrahend	1916847	Proof 99252847

2 What is the cube root of 84604519? Ans. 439.
3 What is the cube root of 259694072? Ans. 638.
4 What is the cube root of 32461759? Ans. 319.
5 What is the cube root of 5735339? Ans. 179.
6 What is the cube root of 48228544? Ans. 364.
7 What is the cube root of 673373097125? Ans. 8765.
8 What is the cube root of 7532641? Ans. 196.02+
9 What is the cube root of 5382674. Ans. 175.3+
10 What is the cube root of 15926.972504? Ans. 25.16+

When decimals occur, point the periods both ways, beginning at the decimal point, and if the last period of the decimal be not complete, add one or more cyphers.

A mixed number may be reduced to an improper fraction, or a decimal, and the root thereof extracted.

* A surd is a quantity whose root cannot exactly be formed. A quantity whose root *can* be found, is called a *rational* quantity.

1 What is the cube root of $\frac{648}{1000}$? Ans. $\frac{3}{5}$.
2 What is the cube root of $\frac{250}{686}$? Ans $\frac{5}{7}$.
3 What is the cube root of $\frac{1520}{3130}$? Ans $\frac{4}{5}$.
4 What is the cube root of $12\frac{19}{27}$? Ans. $2\frac{1}{3}$.
5 What is the cube root of $31\frac{15}{343}$? Ans. $3\frac{1}{7}$.

SURDS.

6 What is the cube root of $7\frac{1}{8}$? Ans. 1.93+
7 What is the cube root of $9\frac{1}{6}$? Ans. 2.092+

APPLICATION.

1 The cube of a certain number is 103823; what is that number? Ans. 47

2 The cube of a certain number is 1728; what number is it? Ans. 12.

4 There is a cistern or vat of a cubical form, which contains 1331 cubical feet: what are the length, breadth and depth of it? Ans. each 11 feet.

4 A certain stone of a cubical form contains 474552 solid inches; what is the superficial content of one of its sides? Ans. 6084 inches.

Questions.

What is a *cube?* A cube is a solid body contained by six equal square sides.

What is the *cube root?* It is the length of one side of a cube.

What is the *square* of the cube root? It is the side of a cube.

How do you point off a number whose *cube root* is to be extracted?

What is the first figure of the root? It is the root of the greatest cube in the first period.

When you subtract the cube from the first period, what do you do?

How do you find the divisor?

What is the first step towards finding the subtrahend? What is the second? What is the third?

When a remainder occurs, how do you proceed?

How do you prove the cube root?

Illustration of the Rule for extracting the Cube Root.

The reason for pointing off the number into periods of *three* figures each, is similar to the one given in the Square Root; for the number of figures in any cube will never exceed three times the figures in the root, and will never be more than *two* figures less.

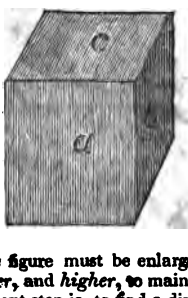
OPERATION.

	15,625 | 25
$2\times2\times2=$	8
$2\times2\times300=1200$	7625
	6000
$5\times5\times2\times30=$	1500
$5\times5\times5=$	125
	7625

In this number there are two periods: of course there will be two figures in the root.

"*The greatest cube in the left hand period* (15) *is* 8; *the root of which is* 2;" therefore, 2 is the first figure of the root, and as we shall have another figure in the root, the 2 stands for 2 tens, or 20. But the cube root is the length of one of the sides of the cube, whose length, breadth and thickness are equal: then the cube whose root is 20, contains $20\times20\times20=8000$.

Fig. 1.



"*Subtract the cube thus found* (8) *from said period, and to the remainder bring down the next period,*" or, subtract the 8000 from the whole given number (15625) and 7625 will remain. Thus 8000 feet are disposed of in the cube, Fig. 1. 20 ft long, 80 ft wide, and 20 ft. high.

The cube is to be enlarged by the addition of 7625 feet which remain. In doing this, the figure must be enlarged on *three* sides, to make it *longer* and *wider*, and *higher*, to maintain the complete cubic form.

The next step is, to find a divisor; and this must be the number of square feet contained in the three sides to which the addition must be made.

Hence we "*multiply the square of the quotient figure by* 300." That is, $2\times2\times300=1200$: or $20\times20\times3=1200$ feet, which is the superficial content of the three sides, A, B, and C.

Fig. 2.

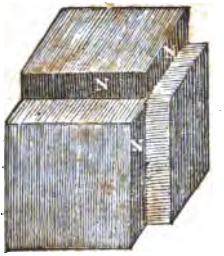


Fig. 3.

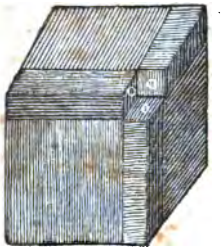


Fig. 4.

This "*divisor* (1200) *is contained in the dividual*" (7625) 5 times: then 5 is the second quotient figure; that is, the addition to each of the three sides is 5 feet thick; if 1200 feet cover the three sides one foot thick, 5 feet thick will require 5 times as many; that is $1200 \times 5 = 6000$.

But when the additions are made to the three squares there will be a deficiency along the whole length of the sides of the squares between the additions, which must be supplied before the cube will be complete. These deficiencies will be three, as may be seen at NNN in Fig. 2; therefore it is that we "*multiply the square of the last figure by the preceding figure, and by* 30," (that is, $5 \times 5 \times 2 \times 30$,) or $5 \times 5 \times 20 \times 3 = 1500$ which is the quantity required to supply the three deficiencies.

Figure 3, represents the solid with these deficiencies supplied, and discovers another deficiency, where they approach each other at ooo.

Lastly, "*cube the last figure;*" this is done to fill the deficiency left at the corner, in filling up the other deficiencies. This corner is limited by the three portions applied to fill the former vacancies, which were 5 feet in breadth; consequently the *cube* of 5 will be the solid contents of the corner. Fig. 4 represents this deficiency (eee) supplied, and the cube *complete*.

Proof.

$20 \times 20 \times 20 =$	8000
$20 \times 20 \times 3 \times 5 =$	6000
$5 \times 5 \times 20 \times 3 =$	1500
$5 \times 5 \times 5 =$	125
$25 \times 25 \times 25 =$	15625

2. If the first term be 4 and the last 40 and the number of terms 13, what is the sum of all the terms?

Ans. 286.

3. What is the sum of the first 100 numbers in their natural order, that is, 1, 2, 3, 4, 5, 6, &c.? Ans. 5050.

4. How many strokes do the clocks of Venice, that go on to 24 o'clock, strike in a day? Ans. 300.

5. If 100 eggs were laid 2 yards distant from each other, and a basket placed 2 yards distant from the first, what distance must a person travel to gather them singly into a basket? Ans. 11 miles, 3 fur. 180 yds.

6. Required the sum of the first ten thousand numbers that are divisible by 3. (3, 6, 9. 12, &c.)

Ans. 150015000.

GEOMETRICAL PROGRESSION.

A series of numbers increasing by a constant multiplication, or decreasing by a constant division, is called a *Geometrical progression.*

Thus, 1, 2, 4, 8, 16, &c. is an increasing geometric series. And 162, 54, 18, 6, &c. is a decreasing geometric series. The constant multiplier or divisor, is called the *ratio*; in the first of the above series the ratio is 2, and in the second 3.

There are five things to be considered in any geometrical progression, viz.

1. The first term.
2. The last term.
3. The number of terms.
4. The ratio.
5. The sum of all the terms

Case 1.

The first term, the ratio, and the number of terms being given, to find the last term.

RULE.—Raise the ratio to a power, whose index is one less than the number of terms; then if it be an increasing series, multiply the first term by the power, otherwise, divide by it, the result will be the last term.

1. What is the 8th term of the geometrical progression whose first term is 4 and ratio 2.

Here the 7th power of 2 is found to be 128, which being multiplied by the first term 4, gives 512 for the 8th term.

The reason of the rule as applied in this example will be obvious, by considering that in finding the successive terms up to the 8th, the first term must be multiplied by 2, that product by 2, that product again by 2, and so on till the 8th term would be found by 7 such multiplications, and it is plain that the same result will be found by first using 2 as a factor 7 times, and then multiplying by 4 the first term, thus:

$2\times2\times2\times2\times2\times2\times2=128\times4=512$ the 8th term,
or $4\times2\times2\times2\times2\times2\times2\times2=512$ the 8th term.

2. Required the tenth term of an increasing series whose first term is 15 and ratio 2? Ans. 7680.

3. The first term of an increasing series is 12, and the ratio 3, what is the 18th term? Ans. 1549681956.

4. A boy purchased 18 oranges, agreeing to pay only the price of the last, at 1 cent for the first, 4 cents for the second, 16 cents for the third, and so on, what was the price of the last? Ans. $171798691,84.

CASE 2.

The extremes and ratio being given, to find the sum of the series.

RULE.—Multiply the last term by the ratio, from the product subtract the first term, and divide the remainder by the ratio less 1, the quotient will be the sum of the series.

The reason of the rule may be shown in the following manner, take any series as, 1, 3, 9, 27, 81, now multiply this by the ratio 3, and it produces the series 3, 9, 27, 81, 243. Now let the sum of the first series be

what it will, it is evident that the sum of the second series will be as many times the first as is expressed by the ratio; subtract the first series from the second and it will give 243—1, which is evidently as many times the sum of the first series, as is expressed by the ratio less 1, therefore 243—1 divided by 3—1 will be the sum of the first series, that is if the last term be multiplied by the ratio, and the first term subtracted from it, and the remainder be divided by the ratio less 1, the quotient will be the sum of the series.

NOTE.—When the last term is not given, as in the following questions, it must be found by case 1.

1. If the first term be 1, the ratio 3, and the last term 177147, what is the sum of the series?

177147
3

3 | 531441
1 | 1

2) 531440

265720 Ans.

2. A rich miser thinking 1000 dollars too great a price for 12 fine horses, offered to give 4 cents for the first, 16 cents for the second, 64 cents for the third, and so on in fourfold proportion to the last; what would the 12 horses come to at that rate? Ans. 223696,20.

3. A goldsmith sold 1 pound of gold at 1 cent for the first ounce, 4 for the second, 16 for the third, &c.; what did it come to? Ans. $55924,05.

4. What sum would purchase a horse with 4 shoes, and 8 nails in each shoe, at 1 mill for the first nail, 2 mills for the second, 4 mills for the third, &c.?

Ans. $4294967,29 cts. 5 mi.

5. A merchant sold 30 yards of silk velvet, at 2 pins for the first yard, 6 for the second, 18 for the third, &c. and sold them at 1000 for a farthing; what did the vel-

vet amount to, and what has gained by the sale, supposing the first cost to have been 100 £ per yard?

Ans. { Amount 214469929£ 5*s*. 3½*d*.
Gained 214466929£ 5*s*. 3½*d*.

6. Suppose a body put in motion should move the length of one barley corn the first second of time, one inch the second, and three inches the third, and so on, increasing its motion in triple proportion geometrical; what distance would it move in the space of 30 seconds, or half a minute? Ans. { 541590730 mi. 3 fur. 29 po. 3½ yd. 1 ft. 1 in. 1 b. c.

POSITION.

Position is a rule by which *true*, or *required numbers* are found by means of *false*, or *supposed* numbers.

SINGLE POSITION.

Single position is the method of resolving questions by working with one false or supposed number.

Those questions belong to this rule, in which the result or number found by the operations on the supposed number, is to the proposed number, as the number given in the question, is to the true or required number, and the following rule is merely an application of the principles of proportion.

Rule.—Suppose any number and perform such operations on it as you would with the answer to prove it. Then say as this result is to the supposed number, so is the number in the question to the number required.

Ex. 1. A teacher being asked how many scholars he had, answered, if I had as many more as I now have, half as many, one fourth as many, and one eighth as many I should have 138; how many scholars had he?

Ans. 48.

Suppose he had	16	Then as 46 : 16 :: 138 :	proof.
As many more	=16	16 :	48
as many	= 8		48
as many	= 4	828	24
as many	= 2	138	12
			6
	46	46)2208(48 Ans.	
		184	138
		368	
		368	

2. A, B, and C, talking of their ages, B said that his age was once and a half the age of A; and C said that his age was once and one tenth the age of both, and that the sum of all their ages was 105 years; what was the age of each? Ans. A's 20, B's 30, and C's 55 yrs.

3. A person after spending one half, and one third of his money had 12 dollars left, how much had he at first? Ans. $72.

4. A man being asked his age, answered that if its fourth, its sixth, its ninth, and its twelfth were added to it, that the sum would be 58 years; what was his age? Ans. 36 yrs.

5. A farmer being asked how many sheep he had, answered that he had them in four pastures, in the first he had one third of his flock, in the second one fourth, in the third one sixth, and in the fourth 49; how many sheep had he? Ans. 196.

6. A man being asked how many oxen, how many cows, and how many sheep he had, answered that he had 3 times as many cows as oxen, and 9 times as many sheep as cows, and that the whole number was 341; required the number of each sort?

Ans. 11 oxen, 33 cows, and 297 sheep.

DOUBLE POSITION.

Double position is the method of resolving questions by working with two false or supposed numbers. Those questions belong to this rule, in which the result found by the operations performed on the supposed numbers, is

not to the supposed number as the number given in the question is to the true number.

RULE.—Suppose any two numbers and perform such operations on each as is required by the conditions of the question, noting the error in each case.

Then multiply the first error by the last supposition, and the last error by the first supposition.

Then if the errors are alike, that is both greater, or both less than the given number, take their difference for a divisor, and the difference of their products for a dividend; but if the errors are unlike, that is one greater and the other less than the given number, take their sum for a divisor, and the sum of their products for a dividend; and the quotient in either case will be the number required.

The reason of the rule cannot be properly shown without the aid of Algebra.

Ex. 1. There is a number, which being increased by its third, its fourth, and 20 more will be doubled; what is the number? Ans. 48.

Suppose 12	Suppose 24
$\frac{1}{3} = 4$	$\frac{1}{3} = 8$
$\frac{1}{4} = 3$	$\frac{1}{4} = 6$
20	20
39	58
$12 \times 2 = 24$	$24 \times 2 = 48$
Error 15	Error 10
24	12
60	120
30	
1st error, 15 — 360	
2d error, 10 — 120	
difference, 5) 240	
48 Ans.	

2. A and B commenced trade with equal sums of money, A gained a sum equal to one fifth of his stock, and B lost $200, then A's money was double that of B; what was the stock of each? Ans. $500.

3. A and B talking of their ages, says A to B, four fifths of my age is equal to seven eighths of yours, and the sum of our ages is 67 years; what were their ages?
Ans. A's 35, and B's 32 yrs.

4. A man has two silver cups of unequal weight, having one cover to both weighing 5 oz. now if the cover be put on the less cup they will be double the weight of the greater, but if the cover be put on the greater cup, they will be three times the weight of the less; what is the weight of each? Ans. 4 oz. and 3 oz.

5. There is a fish whose head is 10 feet long, his tail is as long as his head and half his body, and his body is as long as his head and tail; what is the whole length of the fish? Ans. 80 feet.

6. A laborer hired for 40 days, upon the condition that he should receive 20 cts. for every day he worked, and forfeit 10 cts. for every day he was idle; at settlement he received 5 dollars, how many days did he work, and how many days was he idle?
Ans. He wrought 30 days, and was idle 10.

EXCHANGE.

The object of exchange is to find how much of the money of one country is equivalent to a given sum of the money of another.

By the *par of exchange* between two countries is meant the intrinsic value of the one, compared with the other: it is estimated by the weight and fineness of the coins.

The *course of exchange* at any time, is the sum of the money of one country which at that time is given for a certain sum of the money of another country. The course of exchange varies according to the circumstances of trade All the calculations in exchange can be performed by the rule of three.

Ex. 1. If 1£ sterling is worth $4,44 cts. 4 ms. ; what is 65£ sterling worth? Ans. $288,86.

2. What is the value of $500 in English money, at $4,44,4, per £ sterling? Ans. 112£ 10s. 2½d.

3. What is the value of 125£ 7s. at $4,44,4, per £ sterling? Ans. $557,05,5.

4. What is the value of $1000, in English money, at $4,44,4, per £ sterling Ans. 225£ 5¼d.

PROMISCUOUS EXERCISES.

1. A merchant had 1000 dollars in bank; he drew out at one time $237.50, at another time, $116.09, and at another, $241.06¼: after which he deposited at one time 1500 dollars, and at another time $750.50; how much had he in bank after making the last deposite?

Ans. $2655.84¼.

2 Sold 8 bales of linen, 4 of which contained 9 pieces each, and in each piece was 35 yards; the other 4 bales contained 12 pieces each, and in each piece was 27 yards; how many pieces and how many yards were in all? Ans. 84 pieces, 2556 yards.

3 If a man leave 6509 dollars to his wife and two sons, thus—to his wife ⅜, to his elder son ⅖ of the remainder, and to his other son the rest; what is the share of each?

Ans. { Wife's share $2440.87½.
Elder son's $2440.87½.
Other son's $1627.25.

4 What is the commission on $2176.50, at 2¼ per cent? Ans. $54.41⅛.

5 If a tower is 384 feet high from the foundation, a sixth part of which is under the earth, and an eighth part under water, how much is visible above the water?

Ans. 272 feet.

6 How many bricks 9 inches long and 4 inches wide, will pave a yard that is 20 feet square? Ans. 1600.

7 What is the value of a slab of marble, the length of which is 5 feet 7 inches, and the breadth 1 foot 10 inches, at 1 dollar per foot? Ans. $10.23⅛.

8 A certain stone measures 4 feet 6 inches in length,

2 feet 9 inches in breadth, and 3 feet 4 inches in depth; how many solid feet does it contain? Ans. 41 ft. 3 in.

9 A line 35 yards long will exactly reach from the top of a fort, standing on the brink of a river, to the opposite bank, known to be 27 yards from the foot of the wall; what is the height of the wall?

Ans. 22 yards 9¼ inches.+

10 The account of a certain school is as follows, viz. $\frac{1}{16}$ of the boys learn geometry, $\frac{3}{8}$ learn grammar, $\frac{3}{16}$ learn arithmetic, $\frac{3}{16}$ learn to write, and 9 learn to read: what number is there of each?

Ans. { 5 who learn geometry, 30 grammar, 24 arithmetic, 12 writing, and 9 reading.

11 A merchant, in bartering with a farmer for wood at $5 per cord, rated his molasses at $25 per hhd., which was worth no more than $20; what price ought the farmer to have asked for his wood to be equal to the merchant's bartering price? Ans. $6,25.

12 A and B dissolve partnership, and equally divide their gain: A's share, which was $332 50 cts., lay for 21 months; B's for 9 months only: the adventure of B. is required. Ans. $775 83¼ cts.

13 If a water-hogshead holds 110 gals. and the pipe which fills the hogshead discharges 15 gal. in 3 minutes, and the tap will discharge 20 gal. in 5 minutes, and these were both left running one hour, how many gallons would the hogshead then contain; and if the tap was then stopped, in what time would the hogshead be filled?

Ans. 60 gal., and filled in 10 min.

14 A has B's note for $500 75 cts., with 9 months interest, at 6 per cent., due on it, for which B gave him 5064 feet of boards, at 2¼ cts per foot, with 140 pounds of tallow, at 13 cts. per pound, and is to pay the rest in flax seed, at 92½ cts. per bushel; how many bushels of flax seed must A receive, to balance the note?

Ans. 409$\frac{1}{9}\frac{5}{2}\frac{9}{5}$. bushels.

15 A, B, and C, in company, had put in $5762: A's money was in 5 months, B's 7, and C's 9 months: they gained $780, which was so divided, that $\frac{1}{4}$ of A's was $\frac{1}{5}$ of B's, and $\frac{1}{7}$ of B's was $\frac{1}{3}$ of C's: but B, having received

$2087, absconded: what did each gain, and put in; and what did A and C gain or lose by B's misconduct?

Ans. A's share of profit $260
B's do. do. $325
C's do. do. $195
A and C would gain $697 39 cts.

16 When 100 boxes of prunes cost 2 dollars 10 cents each, and by selling them at 3 dollars 50 cents per cwt. the gain is 25 per cent., the weight of each box, one with another, is required. Ans. 84 lb.

17 There are two columns, in the ruins of Persepolis, left standing upright; one is 64 feet above the plain, the other 50. Between these, in a right line stands an ancient statue, the head whereof is 97 feet from the summit of the higher, and 86 feet from the top of the lower column, and the distance between the lower column and the centre of the statue's base, is 76 feet; the distance between the top of the columns is required. Ans. 157+ft.

18 If I see the flash of a cannon, fired from a fort on the other side of a river, and hear the report 47 seconds afterwards, what distance was the fort from where I stood? Ans. 53674 feet.

NOTE.—Sound, if not interrupted, will move at the rate of about 1142 feet in a second of time.

19 What is the difference between the interest of $1000 at 6 per cent. for 8 years, and the discount of the same sum at the same rate, and for the same time?

Ans. The interest exceeds the discount by $155 67 cts. 5 m.

20 If a tower be built in the following manner, $\frac{27}{175}$ of its height of stone, 27 feet of brick, and $\frac{1}{4}$ of its height of wood, what was the height of the tower?

Ans. 113 feet 4 inches.

21 A captain, 2 lieutenants, and 30 seamen, take a prize worth $7002, which they divide into 100 shares, of which the captain takes 12, the two lieutenants each 5, and the remainder is to be divided equally among the sailors; how much will each man receive? Ans. Captain's share, $840,24, each lieutenant's, $350,10, and each seaman's, $182,52.

A PRACTICAL SYSTEM

OF

BOOK-KEEPING,

FOR

MECHANICS AND RETAILERS.

Book-Keeping is the method of recording a systematic account of business transactions.

It is of two kinds—*Single* and *Double Entry*. The former, only, will be noticed in this work. On account of the simplicity of Single Entry, it is, perhaps, the best which can be recommended to farmers, mechanics, and retailers. It consists of two principal books—the *Day Book*, or *Waste Book*, and the *Leger*, and one auxiliary book, the *Cash-Book*.

THE DAY BOOK.

This book is ruled with a column on the left hand for the date, and three columns on the right, the first, for the folio or page of the Leger, to which the account is transferred; and the last two for dollars and cents.

This book exhibits a minute history of business transactions in the order of time in which they occur, with every circumstance, necessary to render the transaction plain and intelligible.

					$	cts.
		David Judkins, Dr.				
Jan.	4	To 10 lbs. coffee at 17 cts.	$1 70			
		" 25 lbs. sugar, at 10 cts.	2 50	1	4	20
		Timothy W. Coolidge, Dr.				
"	4	To 1 bl. sugar, weighing 135 lbs. neat, at 8¼ cts.	$11 47½			
		" 1 bag coffee, 98 lbs. at 15 cents,	14 70	1	26	17½
		Geo. H. Eaton, Dr.				
"	6	To 1 bl. flour,	$3 87½			
		" 1 lb. Y. H. Tea,	1 12½			
		" 1 keg lard, neat weight 60 lbs., at 6¼ cts.	3 75	1	8	75
		David Judkins, Cr.				
"	8	By cash on account,		1	3	00
		James Wilson, Dr.				
"	11	To 3 weeks boarding, at 2 dollars per week,		2	6	00
		Hiram Ames, Dr.				
"	11	To 12 yards broadcloth at 6 dollars per yard,	$72 00			
		" 30 yds. muslin at 14 cts.	4 20	2	76	20
		Cr.				
"	14	By an order on J. Jones, for Groceries,	$51 00			
		" Cash,	20 00	2	71	00
		Timothy W. Coolidge, Cr.				
"	14	By a bill of carpenter work,		1	25	00
		James Wilson, Dr.				
"	15	To 1 bl. vinegar,	$3 25			
		" 1 keg 10d. nails, weight				
		" 111 lbs. at 8 cts.	8 88	2	12	13

			$	cts.
	George Hamilton, Cr.			
Jan. 19	By 1 set of Fancy chairs,		3	25 00
	George H. Eaton, Cr.			
" 21	By cash, to balance account,		1	8 75
	Robert Young, Dr.			
" 25	To cash on account,	$3 00		
	" 10 lbs. N. O. sugar, at " 10 cents,	1 00		
	" 12 lbs. coffee at 16⅔ cts.	2 00		
	" ½ lb. Y. H. Tea,	62½	3	6 62½
	Jackson Moore, Dr.			
" 29	To 21 lbs. Ham, at 10 cts.	$2 10		
	" 1 box soap, 30 lbs. at 5 cents,	1 50	3	3 60
	David Judkins, Dr.			
" 30	To 12 bls. apples at 75 cents,		1	9 00
	Cr.			
	By 47 bush. corn, at 20 cents,		1	9 40
	James Wilson, Cr.			
" 31	By cash on account,		2	15 00
	Thomas Hilton, Dr.			
Feb. 3	To cash,	$5 00		
	" 1 lb. Y. H. Tea,	1 06		
	" 16 lbs. Rice, at 6¼ cts.	1 00	2	7 06
	Cr.			
	By 13 days labor, at 87½ cts.		2	11 37½
	George Hamilton, Dr.			
" 10	To 1 canister Imperial Tea, 14 lbs. at $1 87½ per lb.		26	26 25
	Hiram Ames, Cr.			
" 13	By order on E. Disney for goods,		2	10 00

			$	cts.
	Robert Young, Dr.			
Feb. 15	To 1 box sperm candles,			
	" 25 lbs., at 30 cts. per lb.	$7 50		
	" 2 bu. dried fruit, at $1			
	" 25 per bushel,	2 50	3	10 00
	James Wilson, Dr.			
" 21	To 10 gals. molasses, at 40 cents,	$4 00		
	" 4 lbs. Old Hyson Tea, at 93 cents,	3 72	2	7 72
	Robert Young, Cr.			
" 27	By 12 cords of wood at	$2 25	3	27 00
	Ames & Smith, Dr.			
March 6	To 18 lbs. sole leather, at			
	" 25 cents,	$4 50		
	" 1 side upper leather,	2 75		
	" 3 calf skins, $1 25,	3 75	4	11 00
	Hiram Ames, Dr.			
" 6	To 500 feet white pine boards, at			
	" $12 50 per M.	$6 25		
	" 25 bu. potatoes, at 50 cts.	12 50		
	" 1 ton of Hay,	10 00	2	28 75
	David Judkins, Dr.			
" 8	To 200 lbs. flour, at	$1 75	1	3 50
	Thomas Hilton, Dr.			
" 8	To cash paid his order to William Coolidge,		2	18 75
	George Hamilton, Dr			
" 15	To 1 copy Whelpley's Compend,	$1 25		
	" 1 ream letter-paper,	4 50		
	" 1 doz. Spelling books,	1 00	3	6 75

			$	cts.
	Theodore P. Letton, Dr.			
Mar. 20	To sharpening his plough,	$1,00		
	" Shoeing his horse,	1,62½		
	" Repairing chain,	.25	4 2	87½
	Timothy W. Coolidge, Dr.			
" "	To 2 qrs. tuition of himself at evening school, at $3 per qr.		1 6	00
	Thomas Hilton, Cr.			
" 23	By the hire of his horse 10 days, at 62½ cts. per day,		2 6	25
	Ames and Smith, Cr.			
" 25	By 1 hhd. sugar, weight 1317 lb. neat, at 7½ cts.		4 98	77½
	T. P. Letton, Dr.			
" 26	To 1 ream wrapping paper,	$1,62½		
	" 1 beaver hat,	5,00		
	" 1 set silver tea-spoons,	6,00	4 12	62½
	Henry C. Sanxay, Cr.			
" 28	By my order on him in favor of Jno. Torrence for stationary,		4 12	87½
	Ames and Smith, Dr.			
" 30	To 2000 ft. clear pine boards, at $20 per M.	$40,00		
	" 500 common do. at $8,	4,00		
	" 5000 shingles, at $2,25	11,25		
	" Cash to balance account,	32,52	4 87	77
" 31	Jackson Moore, Cr.			
	By painting my house,		3 21	00

			$	cts.
	Thomas Hilton, Dr.			
March 31	To 4 bu. wheat, at $1 25,	$5 00		
	" 1 bl. mess pork,	9 00		
	" 2 bu. salt, at 50 cts.	1 00		
	" 8 lbs. brown sugar, 11 cts.	88	2	15 88
	George Hamilton, Dr.			
" 31	To 12 cedar posts, at 25c.	$3 00		
	" 1 plough,	9 37½		
	" 1 scythe,	1 62½	4	14 00
	Jackson Moore, Dr.			
" 31	To repairing his wagon and plough,		3	6 00
	Thomas Hilton, Cr.			
" 31	By 1 pair shoes,	$1 50		
	" 1 mahogany table,	12 50	2	14 00
	George Hamilton, Cr.			
" 31	By an order on J. Hulse,	$5 00		
	" cash,	6 50	3	11 50

END OF THE DAY BOOK.

THE LEGER.

THIS book is used to collect the scattered accounts of the Day Book, and to arrange all that relates to each individual, into one separate statement. The business of transferring the accounts from the Day Book to the Leger, is called *posting*.

The Leger is ruled with a double line in the middle of the page, to separate the debits from the credits. Each side has two columns for dollars and cents, one for the page of the Day Book, from which the particular item is brought, and a column for the date.

When an account is posted, the page of the Leger on which this account is kept, is written in the column for that purpose in the Day Book, and also the page of the Day Book from which the account was posted, is written in the 2d column of the Leger.

In posting, begin with the first account in the Day Book, which you will perceive is the name of David Judkins. Enter his name in the first page of the Leger, in a large, fair hand, with Dr. on the left and Cr. on the right.—As there are several articles charged to D. Judkins on the 4th of January, instead of specifying each article in the Leger, we merely say, *For Sundries*, and enter the amount in the proper columns—see Leger, page 1.

The Leger has an index or alphabet, in which the names of persons are arranged under their initial letters, with the page in the Leger where the account may be found.

ALPHABET TO THE LEGER.

A Ames, Hiram - 2 Ames & Smith - 4	I J Judkins, David - 1	R
B Balance - -	K	S Sankey, H. C. - 4
C Coolidge. T. W. - 1	L Letton, T. P. - 4	T
D	M Moore, Jackson - 3	U
E Eaton, George H. 1	N	V
F	O	W Wilson, Jas. - 2
G	P	X
H Hilton, Thomas - 2 Hamilton, Geo. - 3	Q	Y Young, Robt. - 3
		Z

Dr. *George Hamilton.* **Cr.**

Feb. 10	To Tea,	3	26	25	Jan. 19	Bychairs,	3	25	00
Mar. 15	" Sund.	4	6	75	Mar 31	" Sunds.	6	11	50
" 31	" do.	6	14	00	Apl. 1	*Balance,*		10	50
			47	00				47	00
April 1	To *Bal.*		10	50					

Robert Young.

Jan. 27	To sundries,	3	6	62½	Feb. 27	By wood,	4	27	00
Feb. 15	" do.	4	10	00					
Apl. 1	" *Bal.*		10	37½					
			27	00				27	00
					Apl. 1	By *Bal.*		10	37½

NOTE.—In the above account the difference between the Dr. and Cr. side is $10 37½, by which I perceive that the balance *against me*, in favor of Robert Young, is $10 37½.

Jackson Moore.

Jan. 29	To Sundries,	3	3	60	Mar. 31	By painting,	5	21	00
Mar. 31	" Sunds.	6	6	00					
Apl. 1	" *Bal.*		11	40					
			21	00				21	00
					Apl. 1	By balance bro't down,		11	40

Dr. Ames & Smith. Cr.

Mar. 6	To	Sundries	4	11	00	Mar. 25	By sugar,	5	98	77
" 30	"	do.	5	87	77					
				98	77				98	77

NOTE.—This account, like the one on the first page, is fully closed, the amount on the Dr. side being just equal to that on the Cr.

T. P. Letton.

Mar. 20	To	Sundries	5	2	87½	Ap. 1	*By Bal.*		15	50
" 26	"	do.	5	12	62½					
				15	50				15	50
April 1	To	balance		15	50					

NOTE.—In the above account there is no sum on the Cr. side, and the inference is, that T. P. Letton owes me $15 50 for sundry articles expressed in detail, in the Day Book, page 5.

Henry C. Sanxay.

Apl. 1	*To balance,*		12	87½	Mar. 28	By my order,	5	12	87½
			12	87½				12	87½
					Apl. 1	*By bal.*		12	87½

NOTE.—In this account it will be perceived that as there is no amount charged to H. C. Sanxay, on the Dr. side, I owe him $12 87½.

Dr.				Balance.				Cr.			
April 1	To D. Judkins,	1	4	30	April 1	By R. Young,	3	10	37½
	" T. W. Coolidge,	1	7	17½		" J. Moore,	3	11	40
	" H. Ames,	2	23	95		" H. Sanxay,	4	12	87½
	" T. Hilton,	2	10	06½					
	" J. Wilson,	2	10	85					
	" G. Hamilton,	3	10	50					
	" T. P. Letton,	4	15	50					
			82	34				34	65

NOTE.—This account exhibits the exact state of your books. It is made from the preceding accounts in the Leger. The Dr. side is an exhibit of the amounts due *to you* by others, and the Cr. side the amounts due *by you* to others. It is not strictly necessary that this account should be introduced in the Leger in single entry: it will be found convenient, however, to balance the book at stated intervals, and transfer the *balances* to the new accounts below, as in the preceding Leger, and when that is done, a *balance account* like the above, will be found convenient, as presenting, *at one view*, the exact state of your Leger.

FORM OF A BILL FROM THE PRECEDING.

Mr. David Judkins,

To Edward Thomson, Dr.

January 4	To	10 lbs. coffee at 17 cts.	$1 70	
		25 lbs. sugar at 10 cts.	2 50	
				4 20
" 30		12 bbls. apples at 75 cts.		9 00
March 8		200 lbs. flour at $1 75,		3 50
				16 70
		Cr.		
January 8	By	Cash,	$3 00	
30		47 bushels corn at 20 cts.	9 40	
				12 40
		Errors excepted.	Balance due,	4 30
		Rec'd payment in full,	EDWARD THOMSON.	

THE CASH BOOK.

The Cash Book is used to record the daily receipts and payments of money. It is ruled nearly the same as the Leger; the Dr. side exhibits the amount of money *received*, and the Cr. side, the amount *paid out*. Subtract the sum of the Cr. from that of the Dr. and the balance will always be equal to the amount of cash on hand.

FORM OF A CASH BOOK.

Dr.			Cash.		Cr.			
1833					1833			
Jan. 1	To cash on hand,		73	81	Jan. 1	By rent of house paid T. P. Letton,	18	00
" 1	Cash rec'd of J. Young.		16	40		Paid note to R. Hand,	50	00
" 1	" " H. Sanxay.		25	00	" 1	Family expenses,	4	37
" 1	" " D. Judkins		10	00	" 1	*By cash on hand,*	52	84
			125	21			125	21
Jan. 2	To cash on hand,		52	84		By cash paid Ames &		
" 2	" of T. Coolidge,		23	16	Jan. 2	Smith,	20	00
" 2	Cash found on Main St.		29	00	" 2	*By cash on hand,*	85	00
			105	00			105	00
Jan. 3	To cash on hand,		85	00				